SOIL SURVEY

Newton County Indiana

Series 1941, No. 14
Issued March 1955

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

How to Use THE SOIL SURVEY REPORT

FARMERS who have worked with their soils for a long time know about the soil differences on their farms, perhaps also on the farms of their immediate neighbors. What they do not know, unless soil surveys have been made, is how nearly their soils are like those on experiment stations or on other farms, either in their State or other States, where farmers have gained experience with new or different farming practices or farm enterprises. They do not know whether higher yields obtained by farmers in other parts of their county and State are from soils like theirs or from soils so different that they could not hope to get yields as high, even if they followed the same practices. One way for farmers to do away with some of the risk and uncertainty involved in trying new production methods and new varieties of plants is to learn what kinds of soils they have so that they can compare them with the soils on which new developments have proved successful.

SOILS OF A PARTICULAR FARM

A soil map accompanies this report. To find what soils are on any farm or other land, it is necessary first to locate this land on the map. This is easily done by finding the township in which the farm is located and by using landmarks such as roads, streams, villages, dwellings, and other features to locate the boundaries.

Each kind of soil mapped within the farm or tract is marked on the map with a symbol. For example, all the areas marked Cb are Chalmers silt loam. The color in which the soil area is shown on the map will be the same as the color indicated on the legend for the particular type of soil. If you want information on the Chalmers soil, turn to the section in this publication on Soil Descriptions and find Chalmers silt loam. Under this heading you will find a statement of what the characteristics of this soil are, what it is mainly used for, and some of the uses to which it is suited.

Suppose, for instance, you wish to know how productive Chalmers silt loam is. You will find it listed in the left-hand column of table 8. Opposite the name you can read the yields for different crops grown on the soil. This table also gives estimated yields for all the other soils mapped in the county.

If, in addition, you wish to know what good use and management practices are recommended for Chalmers silt loam, read what is said about this in the section on Soil Descriptions. Refer also to the section headed Management of the Soils, where the soils suited to the same use and management practices are grouped together.

SOILS OF THE COUNTY AS A WHOLE

A general idea of the soils of the county is given in the section on Soils, which tells about the principal kinds of soils, where they are found, and how they are related to one another. After reading this section, study the soil map and notice how the different kinds of soils tend to be arranged in different parts of the county. These patterns are likely to be associated with well-recognized differences in types of farming, land use, and land-use problems.

A newcomer to the county, especially if he considers purchasing a farm, will want to know about the climate; the types and sizes of farms; the principal farm products and how they are marketed; the kinds and conditions of farm tenure; availability of roads, railroads, and electric services; water supplies; industries of the county; and town, village, and population characteristics. Information about all these will be found in the sections on General Nature of the Area and on Agriculture.

Those interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology and Genesis of Soils.

This publication on the soil survey of Newton County, Ind., is a cooperative contribution from the—

SOIL CONSERVATION SERVICE

and the

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

Series 1941, No. 14 Issued March 1955

SOIL SURVEY OF NEWTON COUNTY, INDIANA

By O. C. ROGERS, Division of Soil Survey,[1] Bureau of Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture, in Charge, and T. M. BUSHNELL, T. E. BARNES, SUTTON MYERS, GLENN H. ROBINSON, P. T. VEALE, and A. P. BELL, Purdue University Agricultural Experiment Station

Area inspected by JAMES THORP, Soil Scientist, Division of Soil Survey

United States Department of Agriculture in cooperation with the Purdue University Agricultural Experiment Station

CONTENTS

	Page
General nature of the area	3
Location and extent	3
Physiography, relief, and drainage	3
Climate	6
Water supply	7
Vegetation	7
Settlement and population	12
Industries	12
Railroads and roads	12
Community, farm, and home facilities	13
Agriculture	13
Crops	13
Livestock and livestock products	15
Type, size, and tenure of farms	17
Land use	17
Soil survey methods and definitions	17
Soils	19
Soil series and their relations	20
Soils developed under grass vegetation	20
Soils developed under forest vegetation	21
Soils of alluvial flood plains or stream bottoms	23
Organic soils	23
Soil descriptions	23
Ade fine sandy loam, undulating phase	25
Ade loamy fine sand, undulating phase	26
Alida loamy fine sand	27
Ayr fine sandy loam:	
Undulating phase	27
Eroded undulating phase	28
Berrien loamy fine sand	29
Wind-eroded phase	29
Severely wind-eroded phase	30
Bridgman sand, wind-eroded undulating phase	30
Chalmers loam	30
Chalmers silt loam	31
Chalmers silty clay loam	32
Clarence loam	33
Clarence silt loam	34
Soils—Continued	
Soil descriptions—Continued	
Clyde silty clay loam	34
Coloma loamy fine sand:	
Undulating phase	35
Wind-eroded undulating phase	36
Conrad fine sand	36
Corwin loam	37
Corwin silt loam	38
Crosby silt loam	39
Darroch fine sandy loam	40
Darroch loam	40
Darroch silt loam	41
Deardurff fine sandy loam	42
Della silty clay loam	43
Dillon fine sandy loam	44
Dillon loamy fine sand	45
Edwards muck	46
Burned phase	46
Edwards loamy muck	47
Foresman fine sandy loam	47
Foresman loam	48
Foresman silt loam	49
Granby fine sandy loam	50
Mucky subsoil phase	50
Granby loamy fine sand	51
Gravel and sand pits	52
Griffin fine sandy loam	52
Griffin loam	52
Griffin loamy fine sand	52
Hagener fine sandy loam, undulating phase	53
Hagener loamy fine sand:	
Undulating phase	53
Wind-eroded rolling phase	53
Houghton loamy muck over sand	54
Houghton muck	54
Shallow phase over sand	55
Burned phase over sand	55
Jasper fine sandy loam:	56
Undulating phase	56
Eroded sloping phase	57
Jasper loam:	
Undulating phase	57
Eroded undulating phase	58
Eroded sloping phase	58

[1] The Division of Soil Survey was transferred to the Soil Conservation Service on Nov. 15, 1952.

068833—55——1

	Page
Soils—Continued	
Soil descriptions—Continued	
Jasper silt loam:	
Undulating phase	59
Eroded undulating phase	60
Eroded sloping phase	60
Julian silty clay loam	61
Kaskaskia silt loam	62
Kibbie loam	63
Kibbie silt loam	63
Maumee fine sandy loam	64
Mucky subsoil phase	65
Ferruginous phase	66
Maumee loam	66
Maumee loamy fine sand	66
Miami silt loam:	
Undulating phase	67
Eroded undulating phase	68
Eroded sloping phase	68
Moderately steep phase	68
Morocco fine sandy loam	69
Morocco loamy fine sand	69
Newton fine sandy loam	70
Newton loamy fine sand	71
Odell loam	72
Odell silt loam	73
Parr fine sandy loam, undulating phase	74
Parr loam:	
Undulating phase	74
Eroded undulating phase	75
Severely eroded undulating phase	76
Eroded sloping phase	76
Parr silt loam:	
Undulating phase	77
Eroded undulating phase	78
Eroded sloping phase	78
Eroded moderately steep phase	79
Plainfield fine sand:	
Undulating phase	79
Wind-eroded undulating phase	80
Severely wind-eroded undulating phase	80
Rolling phase	80
Wind-eroded rolling phase	80
Severely wind-eroded rolling phase	81
Rensselaer loam	81
Rensselaer silt loam	82
Rensselear silty clay loam	83
Stockwell loam:	
Undulating phase	84
Eroded sloping phase	85
Strole loam	86
Strole silt loam	86
Swygert loam	87
Swygert silt loam	87
Tippecanoe loam	88
Tuscola loam, undulating phase	89
Tuscola silt loam:	
Eroded undulating phase	89
Moderately steep phase	90
Wabash silt loam	90
Wabash silty clay loam	90
Weiss fine sand	91
Wind-eroded phase	92
Wooten fine sand	92
Wind-eroded phase	93
Use, yields, and productivity ratings of Newton County soils	93
Management of the soils	106
Dark loam, silt loam, and silty clay loam soils of uplands and terraces	114
Light-colored loam and silt loam soils of uplands and terraces	118
Light-colored sandy soils of uplands and terraces	122
Dark sandy soils of uplands, terraces, and outwash plains	125
Organic soils	128
Bottom lands	130
Nonarable land	131
Morphology and genesis of soils	132
Environment and characteristics of the soils	132
Prairie soils	133
Gray-brown Podzolic soils	138
Low Humic Gley soils	140
Humic Gley soils	141
Bog soils	143
Alluvial soils	144

AGRICULTURE has been the leading industry of Newton County since settlement began about 1834. Early settlers established homes in timbered areas and grew corn, wheat, and vegetables mainly for use on the farm. Tillage of the unprotected grasslands began when a plow was developed that would break the tough prairie sod, but great agricultural expansion did not begin until 1859, when the building of railroads provided ready access to markets. The leading crops of the county are corn, oats, soybeans, and hay; and wheat, rye, buckwheat, potatoes, and fruits are also grown. Livestock is an important source of farm income and the medium through which

part of the field crops are marketed. To provide a basis for the best agricultural use of the land, this cooperative soil survey was made by the United States Department of Agriculture and the Purdue University Agricultural Experiment Station. Field work was completed in 1941, and, unless otherwise specifically indicated, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Newton County, situated in the northwestern part of Indiana and bordered by Illinois on the west, is the second county south of Lake Michigan (fig. 1). It is bordered on the south by Benton County, on the east by Jasper County, and on the north by the Kankakee River. Kentland, the county seat, is 100 miles northwest of Indianapolis, the State capital; 40 miles northwest of the Purdue University Agricultural Experiment Station at Lafayette; and 55 miles south of Gary. The total area of the county is 413 square miles, or 264,320 acres.

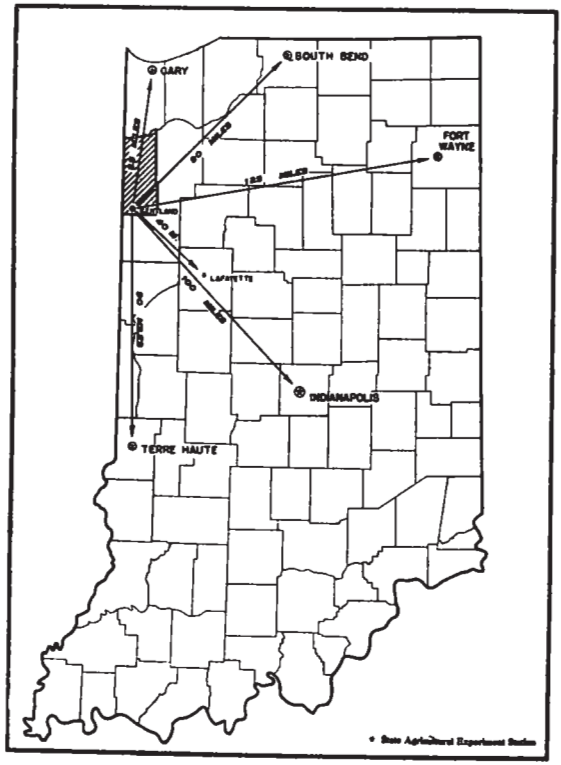

FIGURE 1.—Location of Newton County in Indiana.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

Newton County is covered by a mantle of unconsolidated glacial deposits of morainal material and till and by fluvioglacial materials

associated with lacustrine (lake-laid) deposits.[1a] The deposits vary from a few feet to 100 feet or more thick. Concerning the formations under these deposits it can be said that "the subsurface is occupied by the strata of the Silurian in the central and northern portions of the county and by the Devonian in the southern portions of the county." [2]

The county lies within the Interior Plains, a major physiographic division of the United States. It is located in the Eastern lake section of the Central Lowland province.[3] The extreme southern part is on the Tipton Till Plain, and the rest is in the Northern Moraine and Lake region.

The county can be divided in four main physiographic units: (1) The Kankakee lacustrine section, (2) the Marseilles moraine section, (3) the Iroquois lacustrine section, and (4) the Tipton Till Plain (fig. 2).

The Kankakee lacustrine section is part of a low nearly level tract parallelling the Kankakee River in northwestern Indiana, and low meandering sand dunes or ridges occur irregularly. This area contains all of Lake, Lincoln, McClellan, and Colfax Townships, the northern half of Beaver Township, and the northwestern part of Jackson Township. The sand dunes and ridges consist of windblown material and rise above the lake plain to heights varying from 1 foot to 30 feet or more. The larger dune areas, consisting of a series of small ridges, lie in a general northeast-southwest direction, and many of the individual ridges are crescent-shaped.

A large part of the Kankakee lacustrine section was formerly marshy, and water covered much of it for extended periods. Much of McClellan Township, as well as the western part of Colfax Township, was once covered by Beaver Lake, a shallow body of water about 7¼ miles across at the widest point and about 4½ miles long on its greatest north-south axis. The total area of this lake was about 25 square miles, or 16,000 acres. Beaver Lake has been artificially drained by ditches, and most of the former marshland is now available for crops.

The Marseilles moraine section, a tract averaging about 2½ miles wide, lies south of the Kankakee lacustrine section and extends in a northeast-southwest direction across the county. The topography is undulating to rolling, and sand dunes or ridges occur along the northern boundary. In general, the geologic material is unstratified glacial deposits of silt, sand, clay, rock, and rock flour. In many local areas, however, the material is stratified silt, sand, and clay that shows evidence of water deposition and is similar to the material of the adjacent Iroquois lacustrine section.

The Iroquois lacustrine section lies south of the Marseilles moraine and extends southward to the Tipton Till Plain. The topography is generally undulating to nearly level, but there are narrow steep slopes adjacent to the Iroquois River and its small tributary streams and

---

[1a] HARRELL, M. GROUND WATER OF INDIANA. Ind. Dept. Conserv. Pub. 133, 504 pp. 1935.

[2] LOGAN, W. N., CUMINGS, E. R., MALOTT, C. A., VISHER, S. S., TUCKER, W. M., and REEVES, J. R. HANDBOOK OF INDIANA GEOLOGY. Ind. Dept. Conserv. Pub. 21, 1120 pp., illus. 1922.

[3] FENNEMAN, N. M. PHYSIOGRAPHIC DIVISIONS OF THE UNITED STATES. *In* Assoc. Amer. Geog. Ann. 6: 19–98. 1916.

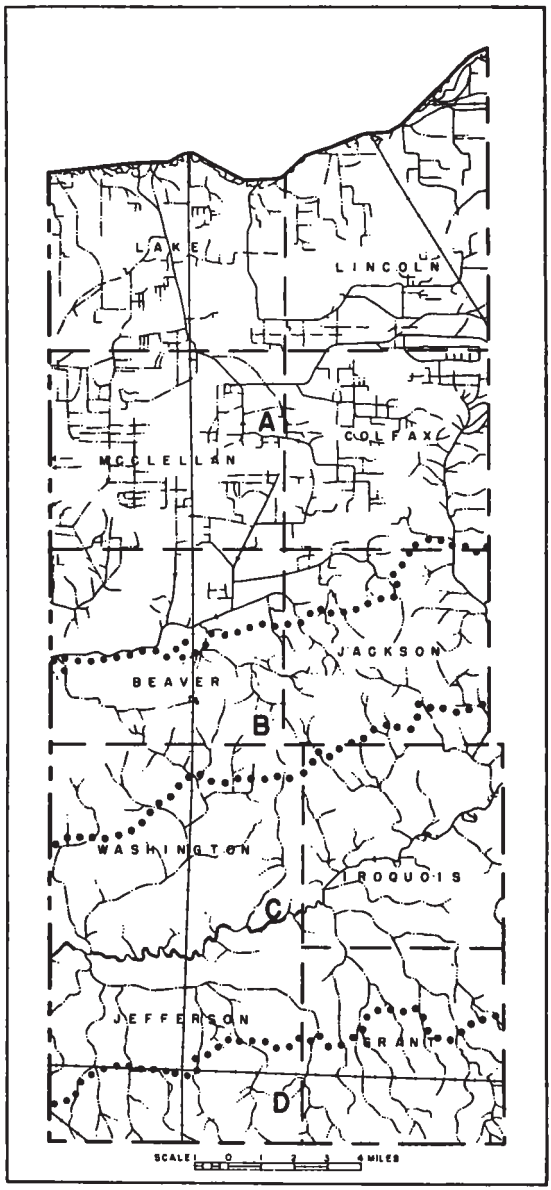

FIGURE 2.—Physiographic and drainage areas of Newton County, Ind.: *A*, The Kankakee lacustrine section; *B*, the Marseilles moraine section; *C*, the Iroquois lacustrine section; and *D*, the Tipton Till Plain.

occasional low sand ridges rise a few feet above the general level of the land. Generally the material consists of stratified silt, sand, clay, and gravel that has been deposited over an undulating till plain of unstratified material similar to the material of the Tipton Till Plain. The stratified material is a few inches to several feet thick, and in the central and western parts of the area is extremely variable. In the

southeastern and north-central parts of Iroquois Township and in small areas in the extreme northern part of Grant Township, the material consists of a thin mantle of silt and sand over heavy lacustrine clay.

The Tipton Till Plain, which includes only the extreme southern part of the county, or that south of the Iroquois lacustrine section, varies from about 1 mile wide in the western part of the county to about 4 miles wide in the eastern. The topography is undulating to gently rolling, and narrow steep slopes occur along drainageways. The material consists of unassorted glacial till and varies in thickness from 1 foot to 100 feet or more. The underlying bedrock is practically exposed at the stone quarry 2 miles east of Kentland, and it outcrops along the valley of a small stream south of Goodland.

The maximum altitude in the county is 770 feet; the minimum, 620 feet; and the average, 655 feet. The maximum range in relief is 150 feet, and the maximum local relief range is 60 feet. Elevations at Thayer and Kentland are 650 and 680 feet, respectively.

The county lies within the Kankakee drainage basin. The Kankakee River forms the boundary of the county on the north. With its immediate tributaries this river drains all of Lake and Lincoln Township, the southern one-third of McClellan Township, and all of Colfax Township except the extreme southern part and about one-third of the eastern. The eastern part of Colfax Township is drained by Lawler ditch and its various branches. Lawler ditch is a tributary of Curtis Creek in Jasper County. Practically all of these drainageways are artificial and present a peculiar pattern as contrasted to the dendritic drainage pattern occurring in the southern part of the county.

Beaver Creek drains the southern part of McClellan Township, all of Beaver Township except the extreme southern part, and the northwestern part of Jackson Township. It enters Illinois almost directly west of Morocco. The rest of the county is drained by the Iroquois River and its tributaries. The Iroquois River enters from Jasper County at the northeastern corner of Iroquois Township, flows southwestward through the county, and unites with the Kankakee River in Illinois. The tributary streams and ditches of the Kankakee River have a dendritic pattern on the Marseilles moraine section to the north and on the Tipton Till Plain to the south, but in general they bend westward after entering the Iroquois lacustrine section and parallel the Iroquois River for a few miles before uniting with it.

CLIMATE

The climate of Newton County is continental, humid, and temperate. There are wide variations in temperature during the year. The range is from an average of 25.9° F. for January to an average of 75.3° for July. In winter cold waves sweep down from the west and northwest, and in summer there are occasional hot dry periods. Such extremes of temperature, however, are usually of short duration. During the season of greatest farm activity and plant growth, or from April to September, inclusive, the average temperature is 65.6°.

The average length of the growing season, as recorded by the weather station at Collegeville in Jasper County, extends from May 3 to October 10, or a period of 160 days. The latest killing frost in spring occurred on May 26, and the earliest killing frost in fall was

on September 11. The frost-free period is usually ample for the growing and maturing of practically all the common crops. Late frosts in spring occasionally damage corn, truck crops, and fruit, however; and early frosts in fall may damage corn. The average growing season in the northern part of the county is probably somewhat less than at Collegeville. This shorter growing period results because the area is several miles farther north, is nearly level over much of its extent, and has poor air drainage. Consequently, frosts may occur in the low wet northern part of the county when none occur on the undulating to rolling well-drained upland.

Rainfall is well distributed throughout the growing season and is usually sufficient for the growth and ripening of practically all the common crops. The average precipitation at Collegeville is 37.77 inches. About 60 percent of the yearly rainfall occurs in the growing season, or from April to September, inclusive. Precipitation usually comes in steady to hard rains, but there is an occasional downpour. Excessive rainfall in spring sometimes retards the planting of corn, oats, and truck crops, and may affect the yield. Periods of drought are infrequent, but when they do occur, crops are injured considerably, especially on the sandier soils. The snowfall varies widely in different years. In years of light snowfall, accompanied by alternate freezing and thawing, alfalfa, clover, and fall-sown grains may be seriously injured by heaving.

A high wind velocity is uncommon, and tornadoes are rare. The prevailing winds are westerly.

Normal monthly, seasonal, and annual temperature and precipitation, as recorded at the United States Weather Bureau station at Collegeville, Jasper County, are given in table 1.

WATER SUPPLY

Water for both household use and livestock is obtained from wells. Ditches, streams, and rivers are an additional source of water for livestock. The wells are dug into unconsolidated material of Recent or Pleistocene geological formations or they are drilled into underlying bedrock of the Devonian and Silurian formations. Sand points driven in the Kankakee Lake Plain to depths of 5 to 15 feet supply abundant water through pitcher pumps. Kentland, Goodland, Brook, and Morocco have good municipally owned water supplies obtained by drilling wells into underlying bedrock.

VEGETATION

Except for a narrow wooded belt adjacent to the Iroquois River and small isolated wooded areas, all of Newton County south of the northern boundary of the Marseilles moraine is in the prairie-grassland region of Indiana. This prairie-grassland area therefore includes three of the four main physiographic divisions of the county—the Marseilles moraine and the Iroquois lacustrine sections and the Tipton Till Plain.

The wet parts of the prairie-grassland area supported button snakeroot, prairie cordgrass, swamp milkweed, bluejoint, and other herbaceous plants; the mesophytic, or medium-moist areas, big bluestem, Indian grass, goldenrod, Canada wild-rye, and other plants; and the dry areas, broomsedge (prairie beardgrass), switchgrass, gayfeather, and other plants.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Collegeville, Jasper County, Ind.*

[Elevation, 672 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snowfall
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	29. 3	64	−27	2. 21	3. 05	3. 21	6. 9
January	25. 9	68	−25	2. 10	. 53	2. 29	8. 2
February	27. 9	69	−23	1. 85	. 70	7. 16	5. 8
Winter	27. 7	69	−27	6. 16	4. 28	12. 66	20. 9
March	39. 2	87	−5	3. 15	2. 23	2. 77	3. 8
April	47. 7	94	9	3. 65	2. 18	5. 76	. 9
May	61. 3	98	27	4. 56	5. 35	3. 38	. 1
Spring	49. 4	98	−5	11. 36	9. 76	11. 91	4. 8
June	70. 5	104	34	3. 73	. 93	5. 42	0
July	75. 3	106	42	3. 88	. 55	5. 02	0
August	73. 0	105	33	3. 52	3. 45	6. 97	0
Summer	72. 9	106	33	11. 13	4. 93	17. 41	0
September	66. 1	103	25	3. 59	2. 60	4. 26	0
October	54. 5	93	13	2. 81	1. 45	2. 62	. 4
November	41. 1	81	−7	2. 72	[1]	4. 20	1. 1
Fall	53. 9	103	−7	9. 12	4. 05	11. 08	1. 5
Year	51. 0	106	−27	37. 77	[2] 23. 02	[3] 53. 06	27. 2

[1] Trace.
[2] In 1914.
[3] In 1909.

The narrow wooded belt along the Iroquois River in the Iroquois lacustrine section supported a tree growth of black, white, red, and bur oaks, hickory, white ash, black cherry, and redhaw (hawthorn), and the shrubs were predominantly dogwood and hazlenut (witch-hazel). The isolated wooded islands on the prairie-grassland area supported a tree growth of the bur oak-elm association, or a growth that included bur oak, hackberry, black cherry, elm, and on the higher knolls, black oak. The growth on the alluvial plains, or first bottoms, of the Iroquois River and its tributaries was Southern cottonwood, American elm, hackberry, silver maple, willow, swamp white oak, and sycamore (planetree).

In the Kankakee lacustrine section, the poorly drained dark sandy tracts supported sedges, bulrushes, prairie cordgrass, hardhack, swamp rose, black chokeberry, sandbar (longleaf) willow, and a few quaking aspen. The growth on the imperfectly drained tracts of the

Kankakee area was pin, jack, and black oaks, pin oak predominating. The sandy dunes and higher ridges supported a tree growth of black, white, and jack oaks, sassasfras, a few scattered small-fruit hickory, and at the base of knolls, pin oak. The bottom areas of that part of the Kankakee lacustrine section once occupied by Beaver Lake had a herb growth including smooth sawgrass, broomsedge, switchgrass, and goldenrod. The flood plains of the Kankakee River had a tree growth of the ash-elm association, and included were silver maple, white and black ash, American elm, river birch, black willow, cottonwood, quaking aspen, hackberry, and pin and swamp white oaks.

The following list, compiled by R. M. Kreibel, former project conservationist of the Soil Conservation Service, United States Department of Agriculture, groups the natural vegetation of the county in nine associations and gives common and scientific names.

PRAIRIE-GRASSLAND REGION, INCLUDING THE MARSEILLES MORAINE AND IROQUOIS LACUSTRINE SECTIONS AND THE TIPTON TILL PLAIN

Scientific name	*Common name* [1]
Wet areas (hydrophytic):	
Asclepias incarnata	Swamp milkweed
Calamagrostis canadensis	Bluejoint, reedgrass
Eryngium aquaticum	Button snakeroot
Spartina pectinata	Prairie cordgrass
Medium-moist areas (mesophytic):	
Andropogon furcatus	Big bluestem, bluejoint turkeyfoot
Desmodium canadense	Canada tickclover
Elymus canadensis	Canada wild-rye
Helianthus giganteus	Giant sunflower
Silphium laciniatum	Compassplant
S. terebinthinaceum	Dock rosinweed
Solidago rigida	Stiff goldenrod
Sorghastum nutans	Indian grass
Dry areas (xerophytic):	
Andropogon scoparius	Little bluestem, prairie beardgrass
Coreopsis tripteris	Tall coreopsis, Atlantic coreopsis
Euphorbia corollata	Flowering spurge
Lespedeza capitata	Roundhead bushclover, roundhead lespedeza
Liatris scariosa	Tall gayfeather
Panicum virgatum	Switchgrass
Silphium integrifolium	Whole-leaf rosinweed

TIMBERED AREAS ON THE IROQUOIS LACUSTRINE SECTION ADJACENT TO THE IROQUOIS RIVER (BLACK OAK-WHITE OAK ASSOCIATION)

Trees:	
Carya ovalis	Small-fruited hickory, red hickory
C. ovata	Shagbark hickory
Crataegus sp	Redhaw, hawthorn
Fraxinus americana	White ash
Prunus serotina	Black cherry
Quercus alba	White oak
Q. borealis var. *maxima*	Northern red oak
Q. macrocarpa	Bur oak, mossycup oak
Q. velutina	Black oak
Shrubs:	
Cornus obliqua	Pale dogwood
Hamamelis virginiana	Hazelnut, common witch-hazel

See footnote at end of list.

WOODED ISLANDS ON THE PRAIRIE (BUR OAK-ELM ASSOCIATION)

Scientific name	*Common name*[1]
Trees:	
Celtis occidentalis	Hackberry
Prunus serotina	Black cherry
Quercus macrocarpa	Bur oak, mossycup oak
Q. velutina	Black oak
Ulmus americana	American elm
U. fulva	Slippery elm

FLOOD PLAINS OF THE IROQUOIS RIVER

Trees:	
Acer saccharinum	Silver maple
Celtis occidentalis	Hackberry
Platanus occidentalis	American sycamore, American planetree
Populus deltoides	Southern cottonwood, Eastern poplar
Quercus bicolor	Swamp white oak
Salix nigra	Black willow
Ulmus americana	American elm

POORLY DRAINED DARK SANDS OF THE MARSHY KANKAKEE LACUSTRINE SECTION

Trees:	
Populus tremuloides	Quaking aspen
Shrubs:	
Aronia melanocarpa	Black chokeberry
Rosa palustris	Swamp rose
Salix interior	Sandbar willow, longleaf willow
Herbs:	
Carex sp	Sedge
Scirpus sp	Bulrush
Spartina pectinata	Prairie cordgrass
Spiraea tomentosa	Hardhack, spirea

IMPERFECTLY DRAINED LIGHT-COLORED SANDS OF THE KANKAKEE LACUSTRINE SECTION

Trees:	
Quercus ellipsoidalis	Jack oak, Northern pin oak
Q. palustris	Pin oak
Q. velutina	Black oak
Shrubs:	
Hamamelis virginiana	Hazelnut, common witch-hazel
Salix humilis	Prairie willow
Vaccinium vacillans	Dryland blueberry
Herbs:	
Baptisia leucophaea	Cream wildindigo, plain wildindigo
Panicum virgatum	Switchgrass

SANDY DUNELIKE WELL-DRAINED AREAS IN THE KANKAKEE LACUSTRINE SECTION (BLACK OAK-JACK OAK-WHITE OAK ASSOCIATION)

Trees:	
Carya ovalis	Small-fruited hickory, red hickory
Quercus alba	White oak
Q. ellipsoidalis	Jack oak, Northern pin oak
Q. palustris	Pin oak
Q. velutina	Black oak
Sassafras albidum	Sassafras

See footnote at end of list.

SANDY DUNELIKE WELL-DRAINED AREAS IN THE KANKAKEE LACUSTRINE SECTION (BLACK OAK-JACK OAK-WHITE OAK ASSOCIATION)—continued

Scientific name	*Common name*[1]
Shrubs:	
Gaylussacia baccata	Black huckleberry
Rubus sp	Blackberry
Vaccinium vacillans	Dryland blueberry
Herbs:	
Andropogon scoparius	Little bluestem, prairie beardgrass
Artemisia caudata	Wormwood

OLD BEAVER LAKE BOTTOMS

Herbs:	
Andropogon scoparius	Little bluestem, prairie beardgrass
Aristida intermedia	Kearney three-awn
Cladium (Mariscus) mariscoides	Smooth sawgrass
Hypericum gentianoides	St. Johnswort
Juncus sp	Rush
Lechea sp	Pineweed
Liatris spicata	Spike gayfeather
Linum sp	Flax
Panicum virgatum	Switchgrass
Rhynchospora sp	Beakrush
Scleria sp	Nutrush, razorsedge.
Solidago sp	Goldenrod
S. nemoralis	Oldfield goldenrod, dyersweed goldenrod.
Viola lanceolata	Lanceleaf violet

FLOOD PLAIN OF THE KANKAKEE RIVER (MAPLE-ASH-ELM ASSOCIATION)

Trees:	
Acer saccharinum	Silver maple
Betula nigra	River birch
Celtis occidentalis	Hackberry
Fraxinus americana	White ash
F. nigra	Black ash
Populus deltoides	Southern cottonwood, Eastern poplar
P. tremuloides	Quaking aspen
Quercus bicolor	Swamp white oak
Q. palustris	Pin oak
Salix nigra	Black willow
Shrubs:	
Alnus rugosa	Alder, hazel
Cephalanthus occidentalis	Common buttonbush
Cornus obliqua	Pale dogwood
Rubus sp	Blackberry
Salix interior	Sandbar willow, longleaf willow
Sambucus canadensis	Elderberry, American elder
Herbs:	
Carex sp	Sedge
Eupatorium rugosum	White snakeroot
Impatiens biflora	Jewelweed, spotted snapweed
Panicum clandestinum	Panic grass
Solidago altissima	Tall goldenrod
S. gigantea	Giant goldenrod

[1] Common names according to STANDARDIZED PLANT NAMES, 2nd Ed., 675 pp., 1942. (Prepared for American Joint Committee on Horticultural Nomenclature by H. P. Kelsey and W. A. Dayton).

SETTLEMENT AND POPULATION

The lowlands of the Kankakee River were a favorite resort of Indians and French and English trappers from the earliest times. At the time of LaSalle's explorations, the area now in Newton County was inhabited by Indians of the Miami Confederation, of which the Potawatomi was the most powerful tribe northwest of the Wabash River.

Before the treaty of 1832 between the United States Government and the Indians, the area now contained in the county was not open to white settlers, and there was little migration. Marshiness prevailing over much of the northern part of the area and the unfavorability of the prairie grasslands discouraged establishment of homes. Except for a narrow irregular area adjacent to the Iroquois River and small isolated bodies, all of the county south of the Marseilles moraine section was covered with a luxuriant growth of native prairie grasses. These prairie areas were avoided because they furnished neither natural protection nor material for fuel and home building, the heavy sod was difficult to plow, and there was the hazard of prairie fires.

The early settlements were made in or along the edges of timbered areas. The early settlers brought only the equipment necessary for farming, and usually the only roads were Indian trails. Many of the trails were impassable at times, and often the settlers were forced to make long detours before reaching their destination.

The first land survey of the area now occupied by Newton County occurred in 1834, and the land was placed on sale at Winamac, Pulaski County, for $1.25 an acre. When Newton County was first established in 1835, it included parts of what are now Lake and Jasper Counties. In 1839, however, Newton and Jasper Counties were consolidated and remained so until 1859, when the present Newton County, the youngest in the State, was organized.

The population of the county was 10,144 in 1900; 9,841 in 1930; and 11,006 in 1950. Kentland, population 1,633 in 1950, is the county seat and principal marketing center for the southwestern part of the county. Morocco, Brook, Goodland, Mount Ayr, Enos, Lake Village, Thayer, and Roselawn are other towns serving as market centers.

INDUSTRIES

Industrial establishments at Kentland process dairy products and manufacture coil springs. A hybrid seed-corn company, also located in Kentland, employs about 60 men throughout the year and as many as 200 during the detasseling season. The hybrid corn for seed is grown in Newton and Benton Counties, Ind., and in eastern Illinois. Limestone for both agricultural use and road building is quarried about 2 miles east of Kentland.

RAILROADS AND ROADS

Main or branch lines of three railroads—the Pennsylvania, the New York Central, and the Chicago, Indianapolis & Louisville—serve practically every town and part of the county. The railroads have been important in the agricultural development of the county because they have enabled farmers to dispose of their grain. The grain is sold to local elevators that ship by train to Chicago and other outside markets.

Practically all of the livestock was formerly shipped by rail, but most of it is now transported by truck.

A network of hard-surfaced highways—United States Highways Nos. 41 and 24 and five State highways—traverse the county. The county roads are good in the area south of Morocco, but many in the northern part are only poor to fair.

COMMUNITY, FARM, AND HOME FACILITIES

The schools of the county are largely of the consolidated type. Grade schools are maintained at Lake Village, Enos, Thayer, Foresman, Roselawn, and in Colfax Township, and consolidated grade and high schools are at Kentland, Goodland, Morocco, Brook, and Mount Ayr. Students are transported by bus to the various high schools. Many churches serve the various religious faiths.

Free mail delivery is made to all districts. Telephone service is available to the central and southern parts of the county but is somewhat limited in the northern. In 1950, 682 farms were served by telephones. Electric service is available to much of the central and southern parts of the county but is limited in the northern. In 1950, 950 farms reported electricity from a power line.

The farm houses and buildings are good in most parts of the county. Most of the farm fences are made of several strands of barbed wire and are usually built well enough to restrict horses and cattle. The farms used for hog raising are usually fenced with woven wire.

AGRICULTURE

The early settlers established homes within or along the edges of timbered areas and avoided the marshy and prairie-grassland tracts. Corn, wheat, and vegetables were the first crops planted, and they were usually grown only in quantities sufficient to supply the needs of the family and livestock. Eventually a plow was developed that could turn the heavy prairie sod, and tillage of the prairies began. Corn produced good crops on the prairie land, but wheat crops were only fair. The distance to market and the lack of good transportation greatly retarded early agricultural development. Livestock, raised to consume the crops grown, served as both a source of cash income and as a meat supply for the farm family.

The building of railroads, which began in 1859, was primarily responsible for the rapid agricultural growth of the county between 1860 and 1900. The steady improvement of the public road system has encouraged the use of motorized transportation.

CROPS

The important crops of the county are corn, oats, soybeans, and hay; but wheat, rye, buckwheat, potatoes, and fruits are among the other crops grown. The acreage of principal crops and number of fruit trees and grapevines are given in table 2 for stated years.

Corn is the most important crop, especially in the prairie areas of the central and southern parts of the county. Most of the corn is grown as a cash crop and marketed through local elevators, but some is fed to livestock on the farms. Cornland is plowed either in fall or early in spring, depending upon weather conditions and the soil

TABLE 2.—*Acreage of principal crops and number of fruit trees and grapevines of bearing age in Newton County, Ind., in stated years*

Crop	1919	1929	1939	1949
	Acres	*Acres*	*Acres*	*Acres*
Corn:				
For grain	56, 962	64, 111	62, 128	80, 158
For silage	(1)	1, 472	982	1, 498
Oats threshed	49, 437	52, 648	28, 418	26, 529
Wheat threshed	11, 640	7, 842	5, 033	11, 022
Rye threshed	5, 368	1, 674	2, 339	1, 057
Barley threshed	229	516	35	(1)
Buckwheat threshed	234	(1)	596	21
Soybeans threshed	3	3, 456	18, 807	(1)
Cowpeas threshed	2	95	74	(1)
All hay	7, 466	8, 195	14, 322	8, 001
Timothy alone	3, 487	(1)	(1)	(1)
Timothy and clover mixed	1, 198	2, 650	3, 043	3, 961
Clover alone	681	1, 516	(1)	(1)
Alfalfa	29	173	996	2, 487
Other cultivated grasses	532	181	974	724
Wild, salt, or prairie grasses	1, 315	778	343	(1)
Grains cut green	217	30	157	103
Annual legumes for hay [2]	7	2, 867	8, 809	726
Potatoes for sale or home use	107	235	84	18
All vegetables (potatoes excluded) for sale	66	(1)	(1)	123
	Number	*Number*	*Number*	*Number*
Apple trees	11, 430	8, 982	1, 490	1, 621
Cherry do	1, 145	660	169	240
Peach do	630	1, 241	245	668
Pear do	927	2, 101	875	247
Plum and prune do	717	354	192	126
Grapevines	2, 463	(1)	1, 500	1, 696

[1] Data not available.
[2] Includes soybeans and cowpeas.

type. Fall plowing encourages erosion, especially where the land is more rolling, and the greater part of the rolling cornland is left for spring plowing. Before planting, the ground is thoroughly disked and then smoothed with either a harrow or a cultipacker. Most farmers use power machinery for plowing and preparing the seedbed. Hybrid seed is used almost exclusively. Corn may be cut and shocked in the field, cut for silage, husked in the field, or hogged off. The greatest acreage of corn is now harvested in the field with mechanical pickers.

Oats usually follow corn, wheat, or soybeans and are sometimes sown where legume crops have failed. A seedbed is prepared by plowing or disking. Oats are broadcast or drilled the latter part of April or early in May. In some areas oats are sown broadcast directly on the corn stubble and then disked in. Only a few farmers use fertilizer with oats. Although some of the oat crop is cut for hay, the larger acreage is threshed or combined. The oats threshed are sold to local elevators for the most part, but some are fed on the farm. The oat acreage declined approximately 46 percent between 1919 and 1950.

Wheat is a minor small-grain crop grown in no particular part of the county. The most common varieties grown in 1952 were Vigo,

Thorn, and Fairfield. Wheat may follow corn, soybeans, or oats, or it may be sown on land where legumes have failed. When it follows corn, wheat is drilled between the corn rows or after the corn has been cut for ensilage or fodder. When it follows soybeans, it is usually drilled without any previous working of the land, but when it follows other crops, the land is prepared by plowing and disking. Wheat is seeded late in September or early in October, usually after the date at which the hessian fly ceases to be a danger. The fly-free date is announced by the Purdue University Agricultural Experiment Station. The general practice is to drill fertilizer with wheat at the time of seeding, but the quantity applied and the kind used vary greatly.

Methods of sowing and harvesting rye are similar to those used for wheat, but little if any commercial fertilizer is used. Barley and buckwheat have always been minor grain crops and are used mostly for feed on the farms.

Soybeans are an increasingly important crop, especially on the prairie areas. They are sown late in May or in June in a thoroughly prepared seedbed. Land is often seeded to soybeans when wheat or clover is winterkilled. Soybeans are grown mainly as a cash crop, but a small acreage is cut for hay.

The types of hay crops grown in the county have changed radically in the last 60 years. Wild, or prairie grasses, an important hay crop during the early development of the county, are now of only minor importance. Timothy grown alone has given way to a mixture of timothy and clover. The acreage of grains cut green has never been large and fluctuates according to the availability of other hay crops. Annual legumes (mainly soybeans) cut for hay came into use after 1919.

Clover and timothy are seeded in fields of wheat and rye or with oats in spring, and either alone or with wheat or rye early in fall. The true clovers—common red, mammoth, and alsike—are most commonly grown and are used for pasture and hay and for soil improvement. Sweetclover is used extensively on the prairie areas as an intercrop. It is sown with oats in spring and turned under as green manure the following spring before the land is planted to corn. Alfalfa, first grown shortly before 1909, has increased in acreage and is now used for hay and pasture, especially on the prairie areas. Farmers are realizing how important liming and fertilizing are to the successful production of clover and alfalfa, especially on the more acid soils, and the quantity of limestone used has greatly increased.

LIVESTOCK AND LIVESTOCK PRODUCTS

Livestock has long been an important source of income and is the medium through which part of the farm crops of the county are marketed. The number of livestock on farms is given in table 3 for stated years, and the quantity of livestock products produced and sold is shown in table 4.

Cattle of both beef and dairy breeds are kept on the farms. Aber deen Angus, Hereford, and Shorthorn are the chief beef breeds. The present trend toward greater use of soil conservation practices has increased the acreage of semipermanent pasture and encouraged the feeding of more cattle. This increase in number of cattle fed is especially evident in the northern parts of the county, where the greatest

TABLE 3.—*Number of livestock and beehives on farms in Newton County, Ind., in stated years*

Livestock	1920	1930	1940	1950
	Number	*Number*	*Number*	*Number*
Horses	6, 798	4, 908	[1] 3, 376	644
Mules	784	593	[1] 269	15
Cattle	18, 583	11, 059	[1] 18, 800	19, 370
Sheep	2, 259	3, 455	[2] 2, 361	2, 521
Swine	26, 155	22, 049	[3] 18, 933	27, 704
Chickens	90, 622	87, 118	[3] 74, 423	[3] 67, 650
Other poultry	4, 602	([4])	1, 415	([5]) 505
Beehives	810	819	442	([5]) 275

[1] Over 3 months old, April 1.
[2] Over 6 months old, April 1.
[3] Over 4 months old, April 1.
[4] Not reported.
[5] Owned in 1949.

TABLE 4.—*Livestock products produced in Newton County, Ind., in stated years*

Livestock products	1919	1929	1939	1949
Dairy products:				
Cows milked—number	([1])	4, 279	4, 810	3, 637
Milk produced—gallons	820, 731	2, 343, 584	2, 606, 184	([1])
Milk sold—do	65, 413	674, 477	1, 332, 451	[2] 9, 277, 668
Cream sold—do	38, 120	2, 507	([1])	([1])
Butterfat sold—pounds	25, 907	373, 603	250, 755	129, 466
Butter churned—do	102, 022	73, 155	30, 114	([1])
Butter sold—do	17, 753	7, 453	3, 393	([1])
Poultry and eggs:				
Chickens raised—number	99, 871	205, 877	213, 397	([1])
Chickens sold—do	43, 191	107, 067	122, 146	15, 919
Eggs produced—dozens	387, 228	655, 434	534, 219	([1])
Eggs sold—do	220, 110	464, 349	([1])	524, 150
Livestock sold alive or slaughtered:				
Cattle and calves—number	([1])	([1])	8, 710	10, 259
Hogs and pigs—do	([1])	([1])	30, 204	37, 957
Sheep and lambs—do	([1])	([1])	1, 684	2, 553
Honey produced—pounds	10, 931	34, 161	19, 243	3, 568
Wax produced—do	285	([1])	([1])	([1])
Sheep shorn—number	1, 279	2, 315	1, 734	1, 363
Wool produced—pounds	9, 679	18, 415	14, 215	10, 660

[1] Data not available.
[2] Pounds of milk sold.

number of cattle is raised. Some of the beef cattle are raised on the farm, but the greater number is purchased from Chicago markets when small, allowed to graze in summer and fall, and then marketed at Chicago. To command a more attractive price, some of the cattle are finished with corn, other grains and hay, and commercial feeds.

The dairy cattle are good grades of Brown Swiss, Guernsey, Jersey, Holstein-Friesian, or a mixture of these breeds. The county lies principally within the Chicago milkshed, and motortrucks daily pick up dairy products from the farms. Most of the milk is sold in fresh

fluid form, or is separated and the cream sold. Practically all the milk consumed in the towns is processed by specialized dairies within the county and in Illinois.

The breeds of swine most common are the Poland China, Duroc, Hampshire, and Chester White. Practically all the swine are marketed at Chicago or are contracted for at the farm by representatives of packing companies.

The number of horses and mules in the county has declined steadily since 1920 because of the increased use of tractors and other power farm machinery. The number of sheep has never been large and has not changed greatly since 1920.

TYPE, SIZE, AND TENURE OF FARMS

In 1950 there were 905 classified farms and 113 miscellaneous and unclassified farms in the county. The classified farms were grouped by type as follows: Field crop farms, 565; livestock farms other than dairy and poultry, 181; general farms, 101; poultry farms, 29; and dairy farms, 29.

The 1,018 farms in the county in 1950 had an average size of 237.3 acres. By size groups, there were 140 farms under 3 to 29 acres in size; 163 farms, 30 to 99 acres; 230 farms, 100 to 179 acres; 406 farms, 180 to 499 acres; and 79 farms, 500 to 1,000 acres or more. Approximately 63 percent of the farms were 100 to 499 acres in size.

Tenants operated 40.5 percent of all farms in 1950; owners, 58.9 percent; and managers, 0.6 percent. The proportion of tenancy has gradually declined since 1920. Two methods of farm rental are practiced—the crops or stock produced by the tenant are shared with the owner or a cash rental is paid. Cash rent varies according to the productivity of the soil, farm improvements and facilities provided, and current price levels.

LAND USE

Farms occupied 91.4 percent of the county area, or a total of 241,603 acres, in 1950. The land in farms was divided as follows: Cropland harvested, failure, and idle or fallow, 165,733 acres; cropland used only for pasture, 21,557 acres; woodland pastured and unpastured, 23,546 acres; other land pastured, 16,490 acres; and all other land in farms, 14,277 acres. In 1950 about 66.9 percent of the land in farms was cropland harvested, and approximately 22.6 percent was cropland, woodland, or other land used for pasture.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examining, classifying, and mapping of soils in the field. The soil scientist walks over the area at intervals not more than one-quarter mile apart and bores into the soil with an auger or digs holes with a spade. Each boring or hole shows the soil to consist of several distinctly different layers, called horizons, which collectively are known as the soil profile. Each of these layers is studied carefully for the physical and chemical characteristics that affect plant growth.

The color of each layer is noted. The darkness of the topmost layer is usually related to its content of organic matter; streaks and spots

968883—55——2

of gray, yellow, and brown in lower layers generally indicate poor drainage and poor aeration.

Texture—the content of sand, silt, and clay in each layer—is determined by the feel of the soil when rubbed between the fingers and is checked by mechanical analyses in the laboratory. Texture determines to a considerable extent the quantity of moisture the soil will hold available to plants, whether plant nutrients or fertilizers will be held by the soil in forms available to plants or will be leached out, and the difficulty or ease of cultivating the soil.

Soil structure, or granulation, and the number of pores or open spaces between soil particles determine the permeability or perviousness of the soil, and consequently, the ease with which plant roots penetrate the soil and water enters it.

Consistence, or the tendency of the soil to crumble or to stick together, determines the degree of difficulty that will be encountered in keeping the soil open and porous under cultivation. Consistence covers such soil characteristics as hardness, friability, plasticity, stickiness, compactness, toughness, and cementation.

Surface soil ordinarily refers to the surface layer, which is usually 5 to 10 inches thick. The layer just below the surface soil is the subsoil; the layer beneath the subsoil, the substratum.

The kinds of rocks and the parent soil material that develops from these rocks affect the quantities and kinds of plant nutrients found in the soil. Simple chemical tests are made to show the degree of acidity of the soil, and the depth to bedrock or to compact layers is determined. The quantity of gravel or rocks that may interfere with cultivation, the steepness and kind of slope, the quantity of soil lost by erosion, and other external features are observed.

On the basis of all the characteristics here listed, soil areas much alike in the kind, thickness, and arrangement of layers are mapped as one soil type. Some soil types are separated into two or more phases. For example, if a soil type has slopes ranging from 2 to 20 percent, the type may be mapped in three phases, an undulating phase (2- to 5-percent slopes), a sloping phase (5- to 8-percent slopes), and a moderately steep phase (12- to 20-percent slopes). A soil that has been eroded in places may be mapped in two or more phases—an uneroded phase, an eroded phase, and perhaps a severely eroded phase. A soil type is broken into phases primarily because of differences in the soil other than those of kind, thickness, and arrangement of layers. The slope of a soil, the frequency of outcropping bedrock, the extent of erosion, or artificial drainage are examples of characteristics that might cause a soil type to be divided into phases.

Two or more soil types may have similar profiles; that is, the soil layers may be nearly the same, except that the texture, especially of the surface layer, may differ. As long as the other characteristics of the soil layers are similar, these soils are considered to belong in the same soil series. A soil series therefore consists of all soil types, whether the number be only one or several, that are, except for texture—particularly the texture of the surface layer—about the same in kind, thickness, and arrangement of layers.

The name of a place near where a soil series was first found is chosen as the name of the series. Thus, in Newton County, Jasper is the name of a series of well-drained soils that have a dark grayish-brown friable surface layer and brown to yellowish-brown subsoil.

They are derived from stratified lake and outwash deposits consisting of sands and silts with some clay and gravel and have formed under grass vegetation.

Areas that have little true soil are not designated with series and type names but are given descriptive names, such as gravel and sand pits, which is the only unit of this kind mapped in the county.

The soil type, or where the soil type is subdivided, the soil phase, is the unit of mapping in soil surveys. It is the unit or kind of soil most nearly uniform and narrowest in range of characteristics. For this reason land use and soil management practices can be more definitely specified for it than for the broader groups of soils that contain more variation. One can say, for example, that soils of the Jasper series are slightly to medium acid and usually require applications of lime for best results with alfalfa. It can be said more specifically that Jasper loam, undulating phase, has slopes of 2 to 5 percent and is well suited to a 4-year rotation that includes 2 years of corn. Jasper loam, eroded sloping phase, however, has slopes ranging from 5 to 8 percent or more and, because control of erosion is somewhat a problem, requires a rotation in which hay and small grains predominate over row crops. It should be kept in permanent pasture where its slopes are strongest and worst eroded.

SOILS

The soils of Newton County vary from one another widely in texture, color, moisture conditions, degree of acidity or alkalinity, extent of erosion, slope, and fertility. In texture, they range from loose sand to heavy silty clay loam. Natural drainage varies from excessive to very poor, and colors range from light gray in imperfectly drained areas of timbered soils to black for the organic soils. In consistence, the range is from tenacious, or sticky, to loose and incoherent. The reaction of the surface soil and subsoil varies from extremely acid for some of the very poorly drained sandy soils, as the Newton and Dillon, to calcareous for Edwards muck.

Water erosion is potentially severe on the more rolling areas. Wind erosion is severe on the sandier soils, especially in the northern part of the county, where blow-outs—areas where wind action has scooped out sand to a depth of 2 to 3 feet—are common on the sand dunes and ridges. In general, tilth is good. The sandy soils are more easily handled and usually can be worked earlier in spring than the heavier textured more clayey soils having similar drainage. The sandy soils are subject to drought and wind erosion, however, and as a whole are less productive than the heavier soils.

All these characteristics have important effects on productivity and influence the use of the various soils. The crops are usually grown on soils to which they are best suited. Soil-depleting crops tend to be grown on the highly productive soils not so quickly depleted or so easily eroded. Nonetheless, there are problems in choice of systems of crop rotation, fertilization, and soil improvement. The soils, each with a particular combination of characteristics, are shown separately on the soil map,[4] but a field may be composed of several soils.

[4] In all parts of the county the change from one soil to another may occur gradually rather than abruptly. The boundary between soils having a gradual transition must be drawn more or less arbitrarily because there is no sharp line of demarcation traceable on the ground.

In the Marseilles moraine and the Iroquois lacustrine sections and on the Tipton Till Plain, the soils occur in small individual bodies closely associated. In the Kankakee lacustrine section they generally occur in larger tracts. Practices are usually designed to suit most nearly the combination of soils making up a field. Also, the size and shape of fields often can be adjusted according to the varying soil conditions.

Artificial drainage is necessary for some of the soils, has been developed in most areas where needed, and has resulted in a lowering of the ground water table. Artificial drainage is especially well developed in the Kankakee lacustrine section, where there is a network of ditches with many tile-drain branches. In many places the ditches are not more than 80 rods apart. In the Iroquois lacustrine section drainage ditches are fewer, but in places tile drains are only a few rods apart. There is a striking difference in drainage patterns among the physiographic divisions of the county (see fig. 2).

SOIL SERIES AND THEIR RELATIONS

The soils of the county are placed in four main divisions: (1) Soils of uplands, (2) soils of glaciofluvial outwash plains and lake plains, (3) soils of flood plains, and (4) organic soils. For convenience in discussion, however, they are grouped as (1) soils developed under grass vegetation, (2) soils developed under forest vegetation, (3) soils of alluvial flood plains or stream bottoms, and (4) organic soils.

SOILS DEVELOPED UNDER GRASS VEGETATION

The soils of the grasslands, developed under a tall prairie-grass vegetation and humid climate, are subdivided on the basis of physiography as (1) soils developed on glacial moraines and till plains and (2) soils developed on glaciofluvial and lake plains and terraces.

SOILS DEVELOPED ON GLACIAL MORAINES AND TILL PLAINS

The soils developed on glacial moraines and till plains under grass vegetation are the Parr, Corwin, Odell, Chalmers, Clyde,[4a] Ade, Ayr, Deardurff, Stockwell, Swygert, and Clarence.

The well-drained Parr, moderately well drained Corwin, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark-colored Clyde soils are developed on highly calcareous light- to medium-textured glacial till and form a catena, or group, of soils. Although the surface soil of the Parr soils is relatively high in content of organic matter as compared with the content in Miami soils, most of the Parr soils are subject to erosion under improper management practices. Corwin soils need artificial drainage for only a few crops, whereas the Odell, Chalmers, and Clyde all require artificial drainage before they can be cultivated successfully.

The sandy Ade soils are excessively drained and occupy undulating to rolling relief in association with Parr and Ayr soils. The Ade soils are somewhat droughty, and wind erosion is severe where improper rotations are used. Ayr soils have a sandy surface soil and upper subsoil, but the lower subsoil is clay loam to loam. Although they are erosive under improper rotations, they are not so droughty as the Ade soils.

[4a] Clyde soils in Newton County were recently renamed Romney.

The Deardurff soil is moderately well drained and has a sandy surface soil and upper subsoil and a loam to clay loam lower subsoil. The organic content is relatively high but is more quickly depleted than in the heavier textured soils, and wind erosion may be severe under clean cultivation. The well drained to somewhat excessively drained Stockwell soils have an organic content about comparable to that of Parr loam soils and are underlain by loose gravel and sand at depths of about 32 to 40 inches. The Stockwell soils are erosive under improper cultivation practices, especially the eroded sloping phase. The Swygert soils are moderately well drained, have a heavier textured subsoil than the Parr, and on comparable slopes are more susceptible to erosion. Clarence soils are imperfectly drained, have a heavy-textured subsoil, and are underlain by clay till. They are more difficult to cultivate than the Parr, Corwin, and Swygert soils and produce lower yields.

SOILS DEVELOPED ON GLACIOFLUVIAL AND LAKE PLAINS AND TERRACES

The soils developed on glaciofluvial and lake plains and terraces are the Hagener, Jasper, Foresman, Darroch, Rensselaer, Della, Tippecanoe, Strole, Julian, and Alida.

The Hagener soils are developed on loose sand, occupy low dunes and ridges, and lie 2 to 15 feet above associated areas of Jasper and Foresman soils. They are droughty and erosive when clean cultivated and are therefore not well suited to corn and oats.

The well to somewhat excessively drained Jasper, moderately well drained Foresman, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained very dark Della soils form a catena developed on calcareous stratified sands and silts with some inclusions of clay and gravel. The organic content is relatively high in all of them but is lowest in the Jasper soils, especially in the two phases of Jasper fine sandy loam. The sloping phases of Jasper soils are subject to erosion under an improper rotation that includes a high proportion of corn and soybeans. The Darroch, Rensselaer, and Della soils require artificial drainage before they can be cropped successfully, but when drained they are all well suited to the general field crops, especially corn and soybeans.

The Strole and the Julian soils are developed on highly calcareous lake-laid clay. They need artificial drainage before cropping and because of the heavy texture of their subsoil and underlying material, are more difficult to drain than the Darroch and Rensselaer soils. The moderately well drained Tippecanoe soil has developed on calcareous gravel and coarse sand. Artificial drainage is usually not necessary, the supply of organic matter is fairly high, and the soil is well suited to the general field crops. The Alida soil is moderately well drained and developed on noncalcareous sandy material. The surface soil and subsoil are strongly acid, and the organic content of the surface soil is moderately high.

SOILS DEVELOPED UNDER FOREST VEGETATION

Soils developed under forest vegetation are subdivided as (1) soils developed on glacial moraines and till plains and (2) soils developed on glaciofluvial outwash and lake plains and terraces.

SOILS DEVELOPED ON GLACIAL MORAINES AND TILL PLAINS

The soils developed on glacial moraines and till plains are the Coloma, Miami, and Crosby. They have light-colored surface soils low in organic content when compared with equivalent soils developed under a grass vegetation. Coloma soils are developed on deep loose sand, are droughty, and are subject to severe wind erosion under clean cultivation. They are not well suited to corn, soybeans, and oats and are probably better suited to alfalfa and wheat. The well-drained Miami and the imperfectly drained Crosby soils are developed on highly calcareous light- to medium-textured glacial till. The Crosby needs artificial drainage for successful crop production, and both the Crosby and Miami need additions of organic matter and complete fertilizers for good crop yields.

SOILS DEVELOPED ON GLACIOFLUVIAL OUTWASH AND LAKE PLAINS AND TERRACES

The soils developed on glaciofluvial outwash and lake plains and terraces are the Plainfield, Bridgman, Berrien, Morocco, Weiss, Wooten, Maumee, Granby, Newton, Dillon, Conrad, Tuscola, and Kibbie.

The Plainfield and Bridgman soils—very low in organic content, light colored, droughty, and subject to severe wind erosion where cultivated—are developed on loose sandy material. They are not suited to corn, soybeans, oats, and wheat and are probably better for rye, alfalfa, and such special crops as melons, cucumbers, and small fruits.

Berrien soils are moderately well drained, and Morocco soils are imperfectly drained. Soils of both series are developed on noncalcareous loose sand and are very low in organic content. They are not well suited to the general farm crops. Some areas of Berrien soils are droughty because associated areas of muck and depressional soils have been drained.

Weiss soils are imperfectly drained and are developed on calcareous sand. They are not well suited to the general farm crops, and wind erosion is severe under clean cultivation. Wooten soils are imperfectly drained and are developed on thin layers of muck or dark sandy material over calcareous sand. Only a relatively small acreage of Wooten soils is under cultivation, as productivity is low.

The dark Granby and Maumee soils are very poorly drained and are developed on loose calcareous sand. Artificial drainage is needed for successful cropping. Organic content is relatively high, but productivity is only medium because of the sandy profile.

Newton and Dillon soils are similar to Granby and Maumee soils, respectively, but their surface soil and subsoil are strongly to very strongly acid. Crop yields are also considerably lower.

The very poorly drained Conrad soil has developed on loose calcareous sand. It is confined to the bed of old Beaver Lake, and a large part is under water late in winter and early in spring. Only a small acreage is cultivated, and yields are low.

The well-drained Tuscola and the imperfectly drained Kibbie are developed on stratified fine sand and silt with some clay and gravel. Artificial drainage is needed on Kibbie soils, and additions of organic matter and complete fertilizers are needed on both the Tuscola and Kibbie for good crop yields.

SOILS OF ALLUVIAL FLOOD PLAINS OR STREAM BOTTOMS

The soils of the alluvial flood plains or stream bottoms—the Kaskaskia, Wabash, and Griffin—occur principally adjacent to the Iroquois River and its larger tributaries or adjacent to the Kankakee River.

The dark well-drained Kaskaskia soil occurs adjacent to the Iroquois River and its tributaries where deposits are washed from uplands and terraces of dark Prairie soils. The imperfectly to poorly drained Wabash soils are associated with the Kaskaskia, and both are largely in pasture. The light-textured Griffin soils occur adjacent to the Kankakee River. A small acreage is cropped to corn and wheat, but the variety of crops is limited because the soils are subject to periodic flooding.

ORGANIC SOILS

The organic soils are the Houghton and the Edwards mucks. These soils occur principally in the northern part of the county, and many of the areas were formerly occupied by shallow lakes. Drainage was very poor, but a considerable part has been drained. The principal crops in drained areas are corn and Irish potatoes. Where drainage is inadequate, the land is in permanent pasture. The burned phases of Houghton and Edwards soils are in low-grade pasture or brush.

SOIL DESCRIPTIONS

In the following pages the soils, identified by the same symbols as those on the soil map, are described and their agricultural relations are discussed. Their acreage and proportionate extent are given in table 5, and their location and distribution are shown on the accompanying map.

TABLE 5.—Acreage and proportionate extent of the soils mapped in Newton County, Ind.

Soil	Acres	Percent
Ade fine sandy loam, undulating phase	698	0.3
Ade loamy fine sand, undulating phase	425	.2
Alida loamy fine sand	349	.1
Ayr fine sandy loam:		
Eroded undulating phase	164	.1
Undulating phase	717	.3
Berrien loamy fine sand	8,452	3.1
Severely wind-eroded phase	599	.2
Wind-eroded phase	177	.1
Bridgman sand, wind-eroded undulating phase	485	.2
Chalmers loam	1,087	.4
Chalmers silt loam	15,042	5.7
Chalmers silty clay loam	11,922	4.5
Clarence loam	125	(1)
Clarence silt loam	466	.2
Clyde silty clay loam	482	.2
Coloma loamy fine sand:		
Undulating phase	798	.3
Wind-eroded undulating phase	266	.1
Conrad fine sand	2,444	1.0
Corwin loam	3,988	1.5

[1] Less than 0.1 percent.

TABLE 5.—Acreage and proportionate extent of the soils mapped in Newton County, Ind.—Continued

Soil	Acres	Percent
Corwin silt loam	6,288	2.4
Crosby silt loam	704	.3
Darroch fine sandy loam	368	.1
Darroch loam	5,423	2.1
Darroch silt loam	6,953	2.6
Deardurff fine sandy loam	2,643	1.0
Della silty clay loam	1,048	.4
Dillon fine sandy loam	4,012	1.5
Dillon loamy fine sand	274	.1
Edwards loamy muck	150	.1
Edwards muck	1,227	.5
Burned phase	439	.2
Foresman fine sandy loam	1,333	.5
Foresman loam	4,206	1.6
Foresman silt loam	1,488	.6
Granby fine sandy loam	9,270	3.5
Mucky subsoil phase	2,093	.8
Granby loamy fine sand	1,103	.4
Gravel and sand pits	66	[1]
Griffin fine sandy loam	491	.2
Griffin loam	1,812	.7
Griffin loamy fine sand	459	.2
Hagener fine sandy loam, undulating phase	1,104	.4
Hagener loamy fine sand:		
Undulating phase	491	.2
Wind-eroded rolling phase	98	[1]
Houghton loamy muck over sand	407	.1
Houghton muck	1,106	.4
Burned phase over sand	1,317	.5
Shallow phase over sand	2,563	1.0
Jasper fine sandy loam:		
Eroded sloping phase	141	.1
Undulating phase	939	.4
Jasper loam:		
Eroded sloping phase	123	[1]
Eroded undulating phase	158	.1
Undulating phase	1,143	.4
Jasper silt loam:		
Eroded sloping phase	224	.1
Eroded undulating phase	232	.1
Undulating phase	710	.3
Julian silty clay loam	4,129	1.5
Kaskaskia silt loam	646	.2
Kibbie loam	726	.3
Kibbie silt loam	438	.2
Maumee fine sandy loam	43,741	16.5
Ferruginous phase	682	.3
Mucky subsoil phase	559	.2
Maumee loam	1,701	.6
Maumee loamy fine sand	4,065	1.5
Miami silt loam:		
Eroded sloping phase	130	[1]
Eroded undulating phase	183	.1
Moderately steep phase	254	.1
Undulating phase	427	.2
Morocco fine sandy loam	488	.2
Morocco loamy fine sand	10,937	4.1
Newton fine sandy loam	5,129	2.0
Newton loamy fine sand	792	.3

[1] Less than 0.1 percent.

TABLE 5.—Acreage and proportionate extent of the soils mapped in Newton County, Ind.—Continued

Soil	Acres	Percent
Odell loam	3,969	1.5
Odell silt loam	6,113	2.3
Parr fine sandy loam, undulating phase	285	.1
Parr loam:		
Eroded sloping phase	418	.2
Eroded undulating phase	2,679	1.0
Severely eroded undulating phase	169	.1
Undulating phase	3,212	1.2
Parr silt loam:		
Eroded moderately steep phase	191	.1
Eroded sloping phase	269	.1
Eroded undulating phase	973	.4
Undulating phase	3,395	1.3
Plainfield fine sand:		
Rolling phase	6,388	2.4
Severely wind-eroded rolling phase	613	.2
Severely wind-eroded undulating phase	370	.1
Undulating phase	4,689	1.8
Wind-eroded rolling phase	3,117	1.1
Wind-eroded undulating phase	551	.2
Rensselaer loam	1,407	.5
Rensselaer silt loam	18,888	7.1
Rensselaer silty clay loam	11,706	4.5
Stockwell loam:		
Eroded sloping phase	28	(1)
Undulating phase	302	.1
Strole loam	322	.1
Strole silt loam	2,683	1.0
Swygert loam	69	(1)
Swygert silt loam	103	(1)
Tippecanoe loam	351	.1
Tuscola loam, undulating phase	144	.1
Tuscola silt loam:		
Eroded undulating phase	117	(1)
Moderately steep phase	107	(1)
Wabash silt loam	1,447	.6
Wabash silty clay loam	538	.2
Weiss fine sand	632	.2
Wind-eroded phase	790	.3
Wooten fine sand	798	.3
Wind-eroded phase	168	.1
Total	264,320	100.0

[1] Less than 0.1 percent.

Ade fine sandy loam, undulating phase (AA).—This excessively drained soil has developed on loose noncalcareous sandy drift. It occurs on low ridges a few feet above the general ground level in association with Parr, Corwin, and Odell soils. Slopes range from 0 to 5 percent, but the dominant relief is 2 to 5 percent. Surface runoff is low to medium and internal drainage is rapid. Permeability is high. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to dark brownish-gray loose fine sandy loam; organic content relatively high; medium acid.

7 to 22 inches, dark grayish-brown to dark-brown fine sandy loam; organic content relatively high but decreases with depth; medium acid.
22 to 70 inches +, brownish-yellow to yellowish-brown loose fine sand; medium acid with a gradual change to slightly acid below 70 inches.

The content of organic matter in the surface soil is somewhat variable, as is the thickness of the dark layers.

Use and management.—Since Ade fine sandy loam, undulating phase, occurs in irregular-sized and irregular-shaped areas closely associated with the heavier textured soils, the crop rotation is necessarily adjusted to the associated soils. The rotation in common use is corn, oats, wheat, soybeans, and hay. The hay is usually a mixture of clover, alfalfa, and timothy. Because the soil is somewhat droughty for oats, there is considerable injury to the crop in June or July. Wheat is better suited than oats because moisture is usually more plentiful early in summer.

Good stands of alfalfa can be obtained if the soil has been limed sufficiently and enough commercial fertilizer high in phosphate and potash is used. Where practical, alfalfa is probably one of the best crops for this soil. Wind erosion is potentially severe under clean cultivation; the soil blows and the moving sands injure young corn and other plants. The supply of organic matter appears to be relatively high but it is not as durable a kind as that in the heavier textured associated soils. Additions of organic matter, either in the form of barnyard or green manure, will probably increase crop yields.

Ade loamy fine sand, undulating phase (AB).—This soil has developed on loose noncalcareous sands in the Prairie soil region in close association with members of the Parr soil catena. The relief is that of low ridges or low fixed dunes, which are usually a few feet above the general level of the area. Slopes range from 2 to 5 percent. The lighter texture of the surface soil and subsoil is the chief difference between this soil and Ade fine sandy loam, undulating phase. Surface runoff is low and internal drainage is rapid. Permeability is very rapid. The soil is susceptible to wind erosion if it does not have a protective cover of close-growing crops or grasses. The native vegetation was principally tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to dark grayish-brown loose loamy fine sand; organic content relatively high but somewhat lower than in the surface soil of the undulating phase of Ade fine sandy loam; medium acid.
7 to 20 inches, dark-brown to dark grayish-brown loose loamy fine sand; organic content somewhat lower than in the layer above; medium acid.
20 to 70 inches, brownish-yellow to yellowish-brown loose fine sand to sand; medium acid but grades to slightly acid or neutral below a depth of 80 to 90 inches.

In color, organic content, and thickness the surface and upper subsoil layers are variable. Included are small areas where a part or all of the surface soil has been removed by wind erosion, and in these the surface is brown to brownish yellow and the organic content is very low.

Use and management.—Crop rotations and management practices on Ade loamy fine sand, undulating phase, are governed somewhat by the size of the areas and by the heavier textured associated soils. The rotation in general use is corn, oats or wheat, soybeans, and hay.

Corn usually follows hay, although it may be grown after oats or soybeans.

Cover crops, especially hay, should predominate in the rotation in order that wind erosion may be prevented and the organic and nitrogen supply increased. Because of droughtiness late in summer, wheat is better suited than oats. Soybeans are occasionally injured by drought late in summer and early in fall, and there is considerable wind erosion on areas planted to that crop. Lime and commercial fertilizer should be used before alfalfa is grown. Alfalfa is probably better suited than corn and soybeans. Fair stands of bluegrass for pasture can be obtained, especially after the areas are limed and fertilized, but there is some injury to the pasture from trampling.

Alida loamy fine sand (Ac).—This soil has developed on loose noncalcareous sandy material in association with Newton, Maumee, Berrien, and other soils in the Kankakee lacustrine section. It occurs on slopes of 0 to about 2 percent. Surface runoff is very low and internal drainage is rapid to very rapid. Wind erosion is potentially severe on clean-cultivated areas. The native vegetation was prairie grasses and some marsh grasses.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to dark brownish-gray loamy fine sand; organic content relatively high; quantity of silt and clay makes material very feebly coherent when moist; strongly acid.
7 to 15 inches, dark grayish-brown to dark brownish-gray loose loamy fine sand; organic content somewhat lower with depth; strongly acid.
15 to 22 inches, yellowish-brown to brownish-yellow loose fine to medium sand; strongly acid.
22 to 80 inches +, mottled yellow and light-gray loose sand; strongly acid in the upper part, with a gradual change to medium acid below a depth of about 60 inches.

The thickness of the dark surface and upper subsoil layers varies from 12 to 18 inches. The Alida soil as mapped in this county differs somewhat from Alida soils mapped in La Porte and St. Joseph Counties, Ind. The surface and upper subsoil layers are lighter textured, and the lower subsoil contains less shale fragments and a greater quantity of quartz sand.

Use and management.—The principal crops on Alida loamy fine sand are corn, soybeans, and oats. Moisture relations are poorer than in the associated Newton and Maumee soils and are comparable with those in the Berrien. Moisture is therefore often the limiting factor in crop production. The lowering of the general water table in the area has made most of the soil droughty. Yields are relatively low. A considerable part of the land is in pasture. If fairly heavy applications of lime and commercial fertilizer are made, fair stands of alfalfa can be obtained. This soil is better suited to wheat and rye than to oats.

Ayr fine sandy loam, undulating phase (Ae).—This soil is characterized by a relatively shallow deposit of sandy material over light-textured glacial till. It occurs on relief of 2 to 5 percent in close association with Parr loam and fine sandy loam soils. Surface runoff is medium to low and internal drainage is moderate to rapid. Erosion, especially by wind, is potentially severe under clean cultivation. The soil developed under a tall prairie-grass vegetation and may be con-

sidered the Prairie analog of the Metea soils, which are developed under a forest vegetation and are not mapped in this county.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to dark brownish-gray loose fine sandy loam; organic content relatively high; medium acid.
7 to 22 inches, dark grayish-brown to dark-brown loose fine sandy loam; slightly coherent when moist; organic content relatively high in upper part but diminishes with depth; medium acid.
22 to 30 inches, brown to brownish-yellow loose fine sandy loam; medium to strongly acid.
30 to 50 inches, brownish-yellow clay loam to silty clay loam; sand content decreases with depth; considerable number of small rock fragments in the lower part; material breaks into very coarse nuciform aggregates; medium to strongly acid in the upper part but gradually changes to slightly acid in the lower.
50 inches +, light-yellow and gray friable calcareous light clay loam to loam calcareous till.

The thickness and organic content of the first two layers are variable, the thickness ranging from 17 to 25 inches. Where this soil grades to Parr fine sandy loam, undulating phase, the total thickness of the sandy material is less than normal; where it grades to the Ade soils, the thickness of the sandy deposit is greater than normal. The depth to calcareous till varies from about 40 to 60 inches.

Use and management.—Because Ayr fine sandy loam, undulating phase, occurs in relatively small areas closely associated with the Parr and Ade soils, the rotation and management practices used are similar to those on the associated soils. The most common rotation is corn, oats or wheat, soybeans, and hay. Clover, alfalfa, and timothy are among the hay crops. Corn usually follows hay, although it may be grown after small grains or soybeans. Wheat is probably better suited than oats, as the somewhat droughty nature of the soil limits yields of oats. Soybeans are grown to a fair extent even though yields are often reduced in seasons of limited moisture.

Corn, oats, and small grains are usually fertilized. Alfalfa will produce good stands after the soil has been limed and fertilized, since it is capable of withstanding drought better than clover. Although the surface and subsurface layers are apparently well supplied with organic matter, the turning under of all available organic matter, including green-manure crops, is essential in maintaining and increasing productivity. Productivity is intermediate between that of Parr fine sandy loam, undulating phase, and Ade fine sandy loam, undulating phase. Part of the soil is in permanent bluegrass pasture. Most of these pasture areas can be improved by liming, fertilizing, and controlling weeds.

Ayr fine sandy loam, eroded undulating phase (Ad).—This soil occurs on slopes of 2 to 5 percent and is closely associated with the undulating phase. Wind erosion has removed 50 percent or more of the surface soil and in some places a considerable part of the subsoil. The surface soil now consists largely of material that was formerly subsoil. The 6- to 8-inch surface layer is dark-brown to brown loose fine sandy loam lower in organic content than the surface soil of the undulating phase. The rest of the profile is comparable with that of the undulating phase.

Use and management.—Ayr fine sandy loam, eroded undulating phase, is cultivated to about the same crops—corn, soybeans, oats,

wheat, and hay—as the undulating phase. Crop yields are lower than those obtained on the undulating phase. This soil is subject to further wind erosion under clean cultivation. If areas are large enough, or wherever practical, this soil is probably best used for alfalfa, a crop that will aid greatly in stabilizing the soil. Good stands of alfalfa should be obtained after the use of lime and commercial fertilizer.

Berrien loamy fine sand (BA).—This soil is the moderately well drained member of the soil catena that includes the excessively drained Plainfield, imperfectly drained Morocco, very poorly drained dark Newton, and very poorly drained very dark Dillon soils. In addition to being closely associated with these soils, it is associated with the Maumee and Granby soils. It developed on loose noncalcareous sand on glacial outwash plains and lake plains. The relief ranges from 0 to 5 percent; in places the soil occurs on low fixed dunes and lies a few feet above areas of Newton and Dillon soils and at a somewhat slightly lower elevation than the Plainfield. Surface runoff is very low and internal drainage is rapid. This soil is susceptible to erosion under clean cultivation or if vegetative cover is not adequate. The native vegetation was chiefly black oak with some pin oak and hickory.

Profile in a cultivated area:

0 to 8 inches, grayish-brown to brownish-gray loose loamy fine sand; low organic content; strongly acid.
8 to 22 inches, pale-yellow to grayish-yellow loose loamy fine sand; strongly acid.
22 to 75 inches +, mottled yellow and gray loose fine sand to sand; intensity of mottling increases with depth; strongly acid to a depth of 75 inches or more, at which depth there is in some areas a gradual change to medium or slightly acid.

Where this soil grades to Morocco soils, the depth to mottling is less than normal, but where it grades to Plainfield soils, the depth to mottling is about 36 inches. Included are a few small areas having a fine sandy loam surface texture but a subsoil and substratum comparable to those of this soil.

Use and management.—Because Berrien loamy fine sand in many places occurs in small irregularly shaped areas closely associated with other soils, several small areas are cultivated to crops that are unprofitable. Although the principal crops are corn, soybeans, and wheat, the soil is not well suited to them because of its droughtiness in summer and early in fall. A few tracts are in alfalfa or a mixture of alfalfa, bromegrass, and timothy. The soil is somewhat suited to small tree fruits and melons, but only a small acreage is used for those crops. Much of this soil is in forest.

The content of organic matter and plant nutrients is low, and constant replacement is necessary. Lack of water is the limiting factor on areas of this soil. Relatively large quantities of lime are necessary for the successful production of alfalfa. Blowing sand causes considerable injury to crops, especially where areas are adjacent to Plainfield soils.

Berrien loamy fine sand, wind-eroded phase (BC).—Three-fourths or more of the surface soil of this phase has been removed by wind erosion, and the greater part of the organic matter and plant nutrients also has been removed. A few areas have small blow-outs where the surface soil and subsoil have been removed by wind action

to a depth of 3 feet or more. Slopes range from 0 to 5 percent. Tilth conditions are poor and productivity is low. A considerable part of this phase is idle or in poor quality pasture consisting largely of various weeds, shrubs, and briers.

Berrien loamy fine sand, severely wind-eroded phase (BB).—This phase occurs on 0- to 5-percent slopes in close association with the wind-eroded phase. Practically all of the surface soil and a considerable part of the subsoil have been removed by wind erosion. Blow-outs are numerous. Little attempt has been made to stabilize erosion or plant trees, pasture grasses, or other protective cover. Areas of this phase are largely in low-grade pasture or idle but probably are best suited to pine or black locust.

Bridgman sand, wind-eroded undulating phase (BD).—This soil occurs on low ranges or dunes within the area that was formerly a part of old Beaver Lake. It has developed on loose sand that overlies dark mineral soil at a depth ranging from 50 to 75 inches. The slope range is 0 to 5 percent. Surface runoff is very low and internal drainage is very rapid. Wind erosion is severe to very severe where the timber has been removed. The native vegetation was oak, with scattered shrubs and grasses.

Profile in a slightly eroded area:

0 to 2 inches, dark-gray loose fine sand; medium organic content; slightly acid.
2 to 50 inches, light brownish-gray to pale-yellow loose fine sand to sand; medium to slightly acid.
50 to 60 inches +, dark-gray to dark brownish-gray loose fine sand extending to variable depths and underlain by light-gray sand; medium to slightly acid.

The greater part of the soil is moderately to severely wind eroded, and there are numerous blow-outs. In the blow-outs the surface and subsoil have been removed to a depth of 5 to 8 feet or more.

Use and management.—No attempt is made to cultivate Bridgman sand, wind-eroded undulating phase. The less severely eroded areas are in forest; the eroded ones are idle and support only a sparse growth of weeds, briers, and brush. This soil has little economic value for production of field crops. It is possible, however, that stands of pine and black locust could be established.

Chalmers loam (CA).—This soil developed on highly calcareous loam to light clay loam glacial till of Late Wisconsin age. It is the very poorly drained member of the soil catena that includes the well-drained Parr, the moderately well drained Corwin, the imperfectly drained Odell, and the very poorly drained very dark Clyde soils. It is closely associated with the soils in the catena and in many places occurs in a dendritic pattern. Areas are nearly level to slightly depressional; relief ranges from 0 to 2 percent. Surface runoff is very low and internal drainage is slow. Under natural drainage most of the areas were ponded a part of each year. The greater part of the soil, however, has been drained artificially. Slight water erosion occurs on small areas, especially at the heads of small drainageways. The native vegetation was principally marsh grasses.

Profile in a cultivated area:

0 to 7 inches, very dark brownish-gray to very dark-gray friable granular loam; high organic content; neutral to slightly acid.

7 to 15 inches, dark-gray to very dark-gray friable heavy loam to clay loam; organic content high in the upper part but decreases with depth; a few faint yellow mottlings may occur in the lower 2 or 3 inches; coarse granular structure becomes fine and blocky; neutral to slightly acid.

15 to 50 inches, mottled gray, yellow, and brown clay loam to silty clay; breaks into very coarse blocky aggregates; somewhat plastic when moist but hard when dry; contains a considerable quantity of partly weathered rock fragments; owing to penetration of material from layer above, the upper 2 or 3 inches are usually stained and somewhat darker; reaction, neutral.

50 inches +, mottled gray and yellow highly calcareous heavy loam to clay loam glacial till composed of unassorted sand, silt, clay, and rock fragments.

The thickness of the first two layers varies from 10 to 17 inches. The content of organic matter in the surface and subsurface layers is somewhat variable, and a few areas have thin deposits of material washed in from surrounding land. Some areas of Rensselaer loam too small to be separated on the map are included. Below a depth of about 30 inches the subsoil in the included areas consists of layers of stratified sand, silt, and in some places clay. The surface texture in some areas on the Marseilles moraine is somewhat variable, and small areas having a sandy loam or a silt loam texture are included.

Use and management.—Except in areas where it makes up most or all of a field, Chalmers loam is managed about the same as the associated Corwin, Odell, and Parr soils. Among the crops grown are corn, soybeans, wheat, oats, and hay. The rotations vary somewhat, depending upon the individual farmer and the proportion of the associated soils. In common use is a rotation of corn, soybeans, and oats, with an intercrop of sweetclover and an occasional crop of hay. Another rotation is 1 year of corn and 1 year of oats, with an intercrop of sweetclover. The sweetclover is turned under the year after the oats are harvested, and the rotation is then repeated. In some areas a rotation of corn and soybeans or of corn, soybeans, and oats is used without a hay crop.

Crop yields are relatively high. Heaving and drowning-out may do some damage to hay crops, especially alfalfa and clover. Oat yields may be affected by lodging, but newer varieties with stiffer straw have reduced this loss somewhat. The soil is excellent for bluegrass pasture. Fertilizer is generally used with corn, wheat, and oat crops but is not so commonly used with soybeans. Crops preceding soybeans often receive large quantities of commercial fertilizer, and the residual effect of this application benefits the soybeans.

Chalmers silt loam (Cb).—This soil has developed on highly calcareous medium-textured glacial till of Late Wisconsin age. It is the very poorly drained member of the soil catena that also includes the well-drained Parr, moderately well drained Corwin, imperfectly drained Odell, and the very poorly drained very dark Clyde soils. It occurs on nearly level to depressional areas; relief ranges from 0 to 2 percent. Natural drainage was very poor, but most areas are artificially drained by tile lines and open ditches to an extent that will permit cultivation. Surface runoff is very low and internal drainage is slow. Many areas were ponded a part of each year under natural drainage conditions. The native vegetation was tall prairie grasses and marsh grasses.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to very dark brownish-gray friable silt loam; high organic content; slightly acid to neutral.
7 to 15 inches, very dark-gray friable heavy silt loam to clay loam; coarse granular structure in the upper part grades with depth to fine and blocky; organic content relatively high in upper part but decreases with depth; some slight yellow staining and mottling occurs in the lower 2 or 3 inches; neutral to slightly acid.
15 to 55 inches, mottled gray, yellow, and brown clay loam to silty clay loam; breaks into very coarse blocky aggregates, plastic when moist and hard when dry; upper 2 or 3 inches darkened somewhat by penetration from the layer above; neutral.
55 inches +, mottled gray, yellow, and brown highly calcareous clay loam glacial till composed of unassorted silt, sand, clay, and rock fragments.

In color and organic-matter content the surface and subsurface layers are variable. In combined thickness these layers vary between the approximate limits of 11 and 17 inches. Some areas, especially those near the heads of draws, have a thin surface layer of silted-in material derived from surrounding land. Where this soil is associated with Rensselaer soils, especially on the Iroquois Lake Plain, the material below a depth of about 30 inches is in some small areas made up of stratified layers of silt, fine sand, and clay.

Use and management.—All of the general crops of the area, including corn, soybeans, oats, wheat, and hay, are grown on Chalmers silt loam. The rotations used are (1) corn, soybeans, and oats or (2) corn and oats, with an intercrop of sweetclover. Where a field is composed largely or entirely of this soil, corn may be grown for two or more consecutive years. The soil is well suited to corn and soybeans, and high yields are obtained in most years. A much larger acreage of oats is grown than wheat. Drowning-out and lodging cause some damage to both crops, but the new varieties with stiffer straw have reduced the loss from lodging. This soil is well suited to both clover and alfalfa without the addition of lime, although some damage to these crops results from drowning-out and heaving.

Chalmers silty clay loam (Co).—This soil has developed on medium- to heavy-textured highly calcareous glacial till of Late Wisconsin age. It is the very poorly drained member of the soil catena that also includes well-drained Parr, moderately well drained Corwin, imperfectly drained Odell, and very poorly drained very dark Clyde soils. It occurs in close association with the soils of the catena and in many places has a dendritic pattern. It occupies nearly level or slightly depressional areas with a relief of 0 to about 2 percent. Natural drainage is very poor, and artificial drainage is necessary for successful crop production. Open ditches and tile lines have established drainage for most areas, but a few need additional drainage. Surface runoff is slow, and under natural drainage conditions a considerable acreage of the soil was ponded part of each year. Erosion is a problem in only a few areas. The native vegetation was tall prairie grasses and marsh grasses.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to nearly black silty clay loam; fine to medium firm granular structure; high organic content; neutral to slightly acid.
7 to 15 inches, dark-gray to very dark-gray heavy silty clay loam to light silty clay; organic content is high in the upper part and decreases with depth; coarse granular structure in the upper part grades with depth to fine and blocky; neutral to slightly acid.

15 to 55 inches, mottled gray, pale yellow, and brown silty clay; material breaks into very coarse blocky aggregates plastic when moist and hard when dry; some penetration of the dark material from the layer above occurs in the upper 2 or 3 inches; content of pebbles and partly weathered rock fragments is variable; neutral.

55 inches +, mottled gray, yellow, and brown highly calcareous clay loam to clay glacial till composed of unassorted silt, clay, sand, and rock fragments.

In organic content the surface and subsurface layers are variable, and in thickness they range from 12 to 17 inches. The intensity of mottling in the subsoil is variable; yellow predominates in many areas. Where this soil grades to the Clyde, its organic content is higher than normal and the subsoil is predominantly gray to a depth of about 30 inches. Included with this soil, especially on the Iroquois Lake Plain, are small areas where the material below a depth of about 30 inches consists of stratified layers of silt, fine sand, and clay. The soil of these included areas resembles the Rensselaer soils.

Use and management.—After artificial drainage has been established, Chalmers silty clay loam is one of the more productive soils in the county for corn and soybeans. Because it usually occurs in close association with other soils and a field consists of a variety of other soils, the rotations and management practices are governed by the extent of the associated soils. Rotations usually include corn, soybeans, and oats, with an occasional crop of alfalfa or mixed hay. A rotation of corn and oats, with an intercrop of sweetclover, is also in common use. Where a field is composed largely or wholly of this soil, the rotation system is usually somewhat different. Corn and soybeans are rotated on some areas where a field consists largely of this soil. The soil is well adapted to bluegrass pasture, but because of its high productivity for field crops, only a small acreage is used for that purpose.

Alfalfa and clover will produce successful crops without liming, but there is some injury from heaving and occasionally from drowning-out. Oats are probably grown more widely than wheat and usually produce good yields. Because of the high nitrogen content of the soil, there is some loss from lodging of oats, but the new stiffer strawed varieties will probably reduce this loss.

Clarence loam (Cᴅ).—The small isolated areas of this soil occur in association with members of the Parr soil catena and with the Swygert soils. The relief ranges from 1 to 3 percent. Surface runoff is low to moderate, and internal drainage is slow to very slow. The soil is derived from a thin deposit of loamy material over clay till.

The surface 6 to 7 inches is dark-gray to dark-brownish gray friable loam relatively high in organic content. The subsoil, to a depth of about 10 to 14 inches, is dark brownish-gray to dark-gray heavy loam to silt loam. The profile below this is comparable with that of Clarence silt loam.

Use and management.—Corn, soybeans, oats, and some wheat and hay are grown on Clarence loam. Because the soil occurs in small isolated areas, rotations and management practices are governed largely by the associated soils. Crop yields are somewhat higher than those obtained on Clarence silt loam, as the surface and subsurface layers are more favorable to plant growth.

968833—55——3

Clarence silt loam (CE).—This soil has developed under a tall prairie-grass vegetation on very heavy-textured calcareous glacial till of Late Wisconsin age. It occurs in small isolated areas associated with members of the Parr soil catena and with the Swygert soils. The relief ranges from 0 to 3 percent. Because of the heavy nature of the subsoil and substrata, erosion is somewhat a problem under clean cultivation. Surface runoff is low to moderate, and internal drainage is slow to very slow. Artificial drainage is usually necessary for more successful crop production.

Profile in a cultivated area:

0 to 6 inches, dark-gray to very dark-gray friable silt loam; medium granular to crumb structure; high organic content; slightly acid.
6 to 10 inches, dark brownish-gray to dark-gray heavy silt loam; coarse granular structure; somewhat lower in organic matter than the layer above; contains a few faint yellow or brown mottlings; slightly to medium acid.
10 to 14 inches, brownish-gray, slightly mottled with yellow, silty clay loam of fine to medium nuciform structure; slightly to medium acid.
14 to 24 inches, mottled yellow, brown, and gray clay of coarse to very coarse blocky structure; plastic when moist and hard when dry; slightly to medium acid in upper part and slightly acid to neutral below.
24 inches +, mottled gray and pale-yellow calcareous clay till.

The total thickness of the dark surface and subsurface layers varies from 8 to 14 inches, and the depth to mottling has about the same variation. The depth to calcareous till ranges from 22 to 30 inches. Included with this soil are a few small areas where a part of the surface soil and a part of the subsoil have been removed by erosion. These included areas are variable in surface texture and color and usually have a somewhat spotted appearance. The texture ranges from silt loam to silty clay loam.

Use and management.—Clarence silt loam occurs in relatively small isolated areas, and in most instances the rotations and management practices are necessarily governed by the associated soils. Corn, soybeans, and oats are the principal crops, although some wheat and hay are grown. The soil is fairly well suited to corn, soybeans, and oats, but yields are lower than those obtained on the associated Odell soils. The heavy subsoil does not allow easy penetration of crop roots and moisture, and the soil may be somewhat droughty when the supply of moisture is abnormally low.

Clyde[4b] silty clay loam (CF).—Highly calcareous medium to moderately heavy-textured glacial till of Late Wisconsin age is the material on which this soil developed. In the soil catena that includes the well-drained Parr, moderately well-drained Corwin, imperfectly drained Odell, and very poorly drained Chalmers soils, this soil is the very poorly drained very dark member. It occupies the lower depressional areas on 0- to 2-percent slopes in association with those soils, principally with the Chalmers.

Natural drainage is very poor, and areas were ponded for a considerable part of the year under natural drainage conditions. Most areas now have artificial drainage sufficient to permit cropping. Surface runoff is very low and internal drainage is very slow. Provided outlets are available, the areas can be drained successfully by use of either tile lines or open ditches. Erosion is not a problem. The native vegetation was marsh grasses.

[4b] See footnote [4a], p. 20.

Profile description:

0 to 7 inches, very dark-gray to nearly black medium granular silty clay loam; very high in content of organic matter; neutral.
7 to 12 inches, very dark-gray silty clay loam of coarse granular structure and high organic content; neutral.
12 to 22 inches, very dark-gray to dark-gray silty clay; organic content not so high as in the layer above and diminishes with depth; breaks into coarse to very coarse blocky aggregates plastic when moist and hard when dry; contains considerable grit and some partly weathered rock fragments; neutral.
22 to 32 inches, light-gray silty clay that breaks into very coarse blocky aggregates; plastic when moist and hard when dry; some faint-yellow mottlings in the lower part; contains considerable quantity of partly weathered rock fragments; neutral.
32 to 44 inches, mottled gray and yellow silty clay; breaks into large irregular blocky aggregates plastic when moist and hard when dry; neutral.
44 inches +, mottled gray and yellow highly calcareous clay loam to silty clay loam glacial till composed of unassorted sand, silt, clay, and rock fragments.

The dark layers vary from 18 to 24 inches in combined thickness. The organic content is somewhat variable but usually high. Where this soil grades to Chalmers soils, the organic content is somewhat less than normal and the subsoil is a little more mottled with yellow.

Use and management.—Because Clyde silty clay loam occurs in small areas closely associated with the Chalmers and the other soils of that catena, the crop rotations are similar. Both corn and soybeans are well suited, and yields are relatively high. Small grains are a little less suitable because they lodge and are impaired by drowning-out and heaving. During periods of abnormally high rainfall water stands for a considerable time, and crops are occasionally damaged. Drainage is the first requisite for crop production. The organic content is high, as is also the nitrogen supply. The quantity of phosphate and potash may be somewhat low, however, and fertilizer high in these plant foods should be used on most crops. Lime is not needed for successful growth of alfalfa and clover, but, if drainage is not adequate, these crops may be injured by drowning-out and heaving. Use of varieties of oats with stiffer straw will help to reduce the loss from lodging. Excellent stands of bluegrass pasture can be obtained, but the livestock carrying capacity could be increased by using phosphate and potash fertilizer and by controlling weeds.

Coloma loamy fine sand, undulating phase (Cg).—This soil has developed on loose sandy drift on slopes of 0 to 5 percent. Surface runoff is very low to low and internal drainage is very rapid. Wind erosion is potentially severe in areas where timber has been removed and a cover crop is not maintained. This soil in many places occurs at slightly higher elevations than the general level of the surrounding areas, and in other places there are long low dunelike ridges that usually extend in an east-west direction. The native vegetation was principally oak with some hickory, maple, and elm.

Profile in a cultivated area:

0 to 8 inches, grayish-brown to light yellowish-brown loose loamy fine sand; low content of organic matter; medium acid.
8 to 20 inches, yellowish-brown loose loamy fine sand to fine sand; contains only enough silt and clay to make it feebly coherent when moist; occasional partly weathered rock fragments; medium to strongly acid.

20 to 75 inches +, brownish-yellow to yellow loose fine sand containing streaks of yellow sandy loam or loamy sand and lenses of slightly heavier textured material; layer extends to a depth of several feet and is underlain by unassorted glacial till; medium to strongly acid in the upper part, changes gradually with increasing depth, and at a depth of 60 inches or more becomes slightly acid or neutral.

In content of partly weathered rock fragments and the mineralogical composition of material the soil is somewhat variable. It contains a higher proportion of minerals other than quartz than the Plainfield soils, but where this phase grades to the Plainfield, the percentage of quartz increases.

Use and management.—Because of the low organic content of the surface soil and the light texture of both the surface soil and subsoil, organic matter and plant nutrients are quickly leached from Coloma loamy fine sand, undulating phase. This soil is not well suited to corn, oats, and soybeans because it is droughty. It is better suited to wheat and rye than other small grains. Alfalfa is better suited than other hay crops. Much of this phase is now in timber or woodland pasture. The pasture is of fair quality, and the livestock-carrying capacity is only fair.

Management requires the addition of all available organic matter, the use of liberal quantities of commercial fertilizer with crops, and the use of fairly long rotations in which the proportion of hay crops is high and that of clean-cultivated crops is low. Applications of lime and commercial fertilizer are usually necessary for successful stands of alfalfa. Wind erosion is a problem, especially on areas where clean-cultivated crops are grown. The shifting sands often damage young plants.

Coloma loamy fine sand, wind-eroded undulating phase (CH) —Wind erosion has removed part or all of the surface soil from this phase, and in some places a part of the subsoil. The native tree vegetation was removed, and the soil has been or is now being cropped or is in pasture. The removal of vegetation has caused the loss of what little organic matter the surface soil contained and has made conditions unfavorable for crop growth. Blow-outs occur where the wind has removed the surface and subsoil to a depth of 3 feet or more. The slope range is 0 to 5 percent.

Use and management.—Coloma loamy fine sand, wind-eroded undulating phase, is not well suited to corn, oats, soybeans, and other field crops in its present condition. Probably it would be best to attempt the establishment of a mixed stand of alfalfa and bromegrass. The areas should receive lime, and commercial fertilizer should be applied before or at the time of seeding. A long-term rotation probably could be used after the hay crop had stabilized the areas and aided in increasing the organic content and plant food supply. The rotation should include a small proportion of clean-cultivated crops and a large one of small grains, as wheat and rye, or a mixture of alfalfa and bromegrass.

Conrad fine sand (CK).—The occurrence of alternate layers of light-gray and dark-gray sand throughout the profile to depths of 36 inches or more characterizes this soil. It has developed on calcareous loose fine sand and sand and occupies a part of the bed of the former Beaver Lake. Slopes are 0 to 2 percent. Surface runoff is very low,

and practically all areas are under water where natural drainage prevails. Drainage is very poor for a part of each year, especially in spring. The native vegetation was a mixture of marsh grasses, herbs, and a few shrubs.

Profile description:

0 to 3 inches, dark-gray loose loamy fine sand; medium organic content; neutral to very slightly acid.
3 to 8 inches, light-gray loose fine sand to loamy fine sand; very low in organic content; neutral.
8 to 12 inches, dark-gray loose fine sand; relatively high organic content; neutral to slightly alkaline.
12 to 20 inches, light-gray loose fine sand to sand; mildly alkaline.
20 to 24 inches, dark-gray loose fine sand to sand; mildly alkaline.
24 to 36 inches +, light-gray loose fine sand to sand with thin layers of dark-gray fine sand; calcareous.

In thickness and sequence the alternating layers of light- and dark-colored sand are notably variable. The dark-colored surface layer is rarely more than 3 or 4 inches thick and its organic content is only medium. Where this soil grades into the Maumee soils, the content of organic matter is slightly higher than normal.

Use and management.—Little of Conrad fine sand is cultivated. The present vegetative cover is largely the natural one of herbs and wild grasses. A considerable acreage of these grasses and herbs is cut for hay in most years. The soil is very low in nitrogen, phosphate, and potash. Drainage is poor, and during part of the year the water table is at or above the surface. In the drier summer months, however, this soil is droughty and subject to wind erosion under clean cultivation. The few small areas planted to soybeans, corn, and oats produce extremely low yields.

Corwin loam (Cl).—This soil has developed on highly calcareous light-textured glacial till of Late Wisconsin age. It is the moderately well drained member of the soil catena that also includes the well-drained Parr, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark Clyde soil. The soil occurs on nearly level to very gently undulating relief where slopes are 0 to 2 percent. The areas are irregular in size and shape and form a complex pattern with soils of the catena. Surface runoff is medium to low; internal drainage is moderate in the upper part and moderate to slow in the lower. The native vegetation was mainly tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to dark grayish-brown friable medium granular loam; relatively high organic content; medium acid.
7 to 15 inches, dark-brown to dark brownish-gray friable heavy loam; organic content is high in the upper part and diminishes with depth; medium acid.
15 to 22 inches, yellowish-brown to pale-yellow light clay loam to light silty clay loam; breaks into fine nuciform aggregates; medium acid.
22 to 34 inches, mottled gray, yellow, and brown clay loam to light silty clay loam of coarse to very coarse nuciform structure; material is medium acid in upper part of layer and gradually changes to slightly acid or neutral in the lower.
34 inches+, mottled gray and yellow highly calcareous loam glacial till composed of unassorted sand, silt, clay, and rock fragments.

The thickness of the dark surface and subsurface layers varies between the approximate limits of 10 and 18 inches, and the depth to

calcareous till ranges from 28 to 40 inches. Included with many areas of this soil, especially those occurring on the Marseilles moraine, are small areas of Deardurff and Foresman fine sandy loams and Parr loam and silt loam soils. The surface texture in these included areas varies from loam to fine sandy loam within short horizontal distances, and small areas are underlain by stratified sand and silt.

Use and management.—Corwin loam is well suited to the common crops of the area. The rotations consist frequently of corn, soybeans, wheat or oats, and hay. A rotation in common use is corn the first year, followed by oats with which sweetclover has been sown. The sweetclover is turned under in spring, following the harvest of the oats, and the rotation repeated.

Corn is well suited and according to general practice, receives an application of commercial fertilizer. Oats are more commonly grown than wheat; commercial fertilizer is generally used with both crops. An application of lime is usually necessary before seeding to alfalfa or clover. Although the organic content seems relatively high, a rotation that includes hay crops at least once every 4 or 5 years will probably be more profitable and produce better yields over a period of years than will a rotation of corn and soybeans or such clean-cultivated crops.

Corwin silt loam (CM).—This soil has developed on highly calcareous light- to medium-textured glacial till of Late Wisconsin age. It is the moderately well-drained member of the catena that also includes the well-drained Parr, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark Clyde soils. The irregularly shaped areas of this soil are closely associated with those in the catena. The relief is nearly level to very gently undulating; slopes range from 0 to 2 percent. Surface runoff is medium to low; internal drainage is moderate in the upper part of the profile and moderate to slow in the lower. Susceptibility to erosion under cultivation is low. The native vegetation was principally tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to dark brownish-gray friable granular silt loam; relatively high organic content; medium acid.

7 to 16 inches, dark-brownish-gray friable heavy silt loam of coarse granular structure; organic content is relatively high in upper part and decreases with depth; medium acid.

16 to 20 inches, brownish-yellow to pale-yellow silty clay loam of fine nuciform structure; some organic material penetrates from the layer above into the upper inch or two; medium acid.

20 to 34 inches, mottled yellow, gray, and brown gritty silty clay loam; coarse to very coarse nuciform structure; some structure faces have dark-gray coating; layer is medium acid in upper part and gradually changes to slightly acid or neutral below.

34 inches +, gray and pale-yellow highly calcareous loam to light-textured clay loam glacial till.

The combined thickness of the dark surface and subsurface layers varies from 12 to 18 inches. The depth to calcareous till varies from 28 to 50 inches. Where this soil grades to the Parr, the depth to mottling is greater than that given in the profile described; where it grades to Odell silt loam, the depth to mottling is less than normal. The subsoil in a few areas is heavy-textured silty clay loam to silty clay with a coarse block structure.

Use and management.—Because Corwin silt loam occurs in close association with Parr and other soils of its catena, it rarely makes up all or the major part of a field. The management practices and rotations used are therefore necessarily governed somewhat by the extent of the various associated soils. A common rotation is corn, oats or wheat, soybeans, and hay. Another rotation in general use is corn for 1 year, followed by oats with which sweetclover has been seeded. The sweetclover is turned under the following spring, and the rotation is repeated. Occasionally a rotation of corn and soybeans is used, but this rotation does not return much organic matter to the soil.

The soil is well suited to corn, oats, wheat, soybeans, and sweetclover. Although the nitrogen content appears to be high, additions of barnyard manure and the plowing under of green-manure crops will increase yields. Liming is usually necessary in securing good stands of both alfalfa and clover. Some areas are in permanent bluegrass pasture of fair to good quality. A number of these pastures could be improved considerably by adding lime and commercial fertilizer and by controlling weeds.

Crosby silt loam (Cn).—Highly calcareous medium-textured glacial till of Late Wisconsin age is the material on which this soil developed. This soil is the imperfectly drained member of the catena that also includes the well-drained Miami, poorly drained Bethel, very poorly drained dark Brookston, and very poorly drained, very dark Clyde soils. The Bethel and Brookston soils do not occur in large enough extent in this county to be mapped separately. Surface runoff is low and internal drainage is slow. Relief ranges from 0 to 2 percent. The native vegetation was maple, elm, ash, oak, hickory, and associated species.

Profile in a cultivated area:

0 to 8 inches, light brownish-gray to brownish-gray friable silt loam; relatively low organic content; slightly to medium acid.
8 to 13 inches, brownish-gray, mottled with light-gray and yellow, heavy silt loam of coarse nuciform structure; medium acid.
13 to 29 inches, mottled gray and yellow gritty silty clay loam; breaks into coarse to very coarse nuciform aggregates slightly plastic when moist and hard when dry; medium to strongly acid but gradually becomes slightly acid or neutral below a depth of 24 inches.
29 inches +, mottled gray and yellow highly calcareous clay loam glacial till composed of unassorted silt, clay, sand, and rock fragments.

The depth to mottling varies from 7 to about 14 inches; the depth to calcareous till, from 25 to 34 inches.

Use and management.—The greater part of Crosby silt loam is cultivated to corn, oats, wheat, soybeans, and hay. Drainage is necessary for successful crop production. Artificial drainage is adequate on most areas, but a few need better drainage. Inasmuch as supplies of both organic matter and nitrogen are low, it is essential that rotations include a relatively high proportion of hay crops and a smaller one of corn. Under good management crop yields are relatively high. Good management includes the incorporation of large quantities of organic matter, liming where necessary, the use of liberal quantities of commercial fertilizer throughout the rotation, and the growing of legumes much of the time. A few areas are in permanent bluegrass pasture, and some of these need liming and fertilizing.

Darroch fine sandy loam (DA).—Areas of this soil occur on lake plains and glaciofluvial outwash and were developed on calcareous stratified layers of sand and silt together with some layers or lenses of clay or gravel. This is the imperfectly drained member of the soil catena that also includes the well-drained Jasper, moderately well drained Foresman, very poorly drained Rensselaer, and very poorly drained very dark Della soils. It occurs in close association with the soils in the catena on nearly level relief of 0- to 2-percent gradient. Surface runoff is low and internal drainage is slow. Where outlets are available, artificial drainage is easily accomplished by use of both tile lines and open ditches. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, very dark brownish-gray loose fine sandy loam; relatively high organic content; slightly to medium acid.
8 to 14 inches, dark brownish-gray to very dark-gray heavy fine sandy loam; organic content relatively high in the upper part but decreases somewhat with depth; lower inch or two of layer has a few faint pale-yellow mottlings; medium acid.
14 to 19 inches, mottled pale-yellow, gray, and brown sandy clay loam to heavy sandy loam; friable to slightly plastic when moist; medium acid.
19 to 32 inches, mottled gray, yellow, and brown sandy clay loam; medium acid.
32 to 50 inches, stratified layers of sand and silt with some layers of clay or fine gravel; medium acid above and grades with depth to slightly acid or neutral.
50 inches +, mottled gray and pale-yellow calcareous stratified layers of sand and silt with some lenses or layers of clay and gravel.

The thickness of the dark surface and subsurface layers ranges from 10 to about 16 inches. The texture of the subsoil is notably variable, the variation depending upon the sequence of the depositional layers. In thickness and sequence the subsoil and the underlying material are also variable within short horizontal distances and from place to place. The underlying material in a few places is fine gravel, especially in the southern part of the Iroquois Lake Plain. The material below a depth of 30 inches is heavy calcareous clay in a few places, particularly in the eastern part of the Iroquois Lake Plain area. Where this soil is associated with the Odell, the underlying material in some places is calcareous till instead of stratified material.

Use and management.—Most areas of Darroch fine sandy loam are cultivated to the general farm crops of the area. Yields are somewhat lower than those obtained on Darroch loam and silt loam, for the organic content of the surface soil is somewhat lower. This soil may be somewhat droughty late in summer and early in fall, especially in seasons of abnormally low rainfall. The rotations are similar to those used on Darroch loam; corn, soybeans, and oats are the principal crops. Some wheat is grown, and the rotation is altered occasionally to include alfalfa grown alone, a mixture of alfalfa, clover, and grasses, or other hay crops.

Darroch loam (DB).—This soil occurs on glaciofluvial and lake plain deposits and developed on calcareous stratified layers of sand and silt with some lenses of clay and fine gravel. It is the imperfectly drained member of the soil catena that also includes the well-drained Jasper, moderately well drained Foresman, very poorly drained Rensselaer, and very poorly drained very dark Della soils. Relief is nearly level, often only a few feet above the depressional areas of

Rensselaer soils; slopes are from 0 to 2 percent. Surface runoff is low and internal drainage is slow. Artificial drainage is necessary for the production of most farm crops. Most areas have been drained, but some still need more adequate drainage, which could be accomplished by use of both open ditches and tile lines. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, very dark brownish-gray friable granular loam; high organic content; slightly to medium acid.
8 to 13 inches, dark brownish-gray to very dark brownish-gray heavy loam showing a few faint yellow mottlings in the lower part; organic content relatively high in the upper part but diminishes with depth; coarse granular structure; medium acid.
13 to 16 inches, pale-yellow silt loam mottled with dark gray and brown; breaks into fine nuciform aggregates friable when moist and only slightly hard when dry; medium acid.
16 to 32 inches, mottled gray, yellow, and brown clay loam to light silty clay loam; breaks into coarse to very coarse nuciform aggregates; medium acid.
32 to 50 inches, mottled gray, yellow, and brown stratified layers of sand and silt with some clay and some fine gravel; medium acid in the upper part and grades with depth to slightly acid in the lower.
50 inches +, calcareous mottled gray and yellow stratified sand and silt with some clay and some fine gravel.

The thickness of the dark surface and subsurface layers is somewhat variable and ranges from 10 to 16 inches. The texture of the subsoil is governed somewhat by the sequence of the depositional layers of sand, silt, clay, and gravel. In some areas the texture is fine sandy loam to a depth of about 30 inches. In thickness and sequence the stratified material below a depth of 30 inches is markedly variable. In some areas the silt loam dominates to a depth of 40 or 50 inches and there are only thin layers of sandy material, but in others the sand dominates and shows only occasional thin layers of silt and clay. The deeper subsoil and underlying material in a few areas is calcareous clay, especially in the eastern part of the Iroquois Lake Plain area.

Use and management.—Darroch loam is well suited to all of the general farm crops of the area, and yields of most crops are relatively high. Rotations and management practices are governed somewhat by the extent of this and the associated soils in a field. A rotation in common use is corn, soybeans, and oats with an intercrop of sweetclover. Another one frequently used is 1 year of corn followed by 1 year of oats and an intercrop of sweetclover. Where the fields are made up largely of this soil and Rensselaer soils, corn and soybeans may be grown alternately for several years. Clover and alfalfa are well suited, but lime is needed on many of the areas for their most successful growth.

Darroch silt loam (Dc).—This soil occurs on lake deposits and glaciofluvial outwash and has developed on calcareous stratified layers of sand and silt with which occur occasional layers of clay or gravel. It is the imperfectly drained member of the soil catena that includes the well-drained Jasper, moderately well drained Foresman, very poorly drained Rensselaer, and very poorly drained very dark Della soils. Relief is nearly level, and slopes range from 0 to 2 percent. The soil usually lies only a few feet above the depressional areas of Rensselaer soils. Surface runoff is low and internal drainage is slow. In most areas artificial drainage sufficient for crop produc-

tion has been developed, but more adequate drainage is needed in a few places. Where outlets are available, artificial drainage is easily accomplished by use of both tile drains and open ditches; exceptions, however, are a few areas where the subsoil and substrata are heavy clay. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, very dark brownish-gray friable granular silt loam; high organic content; slightly to medium acid.
8 to 13 inches, very dark-gray to dark brownish-gray friable heavy silt loam of coarse granular structure; organic content relatively high in the upper part but decreases with depth; medium acid.
13 to 16 inches, mottled pale-yellow, gray, and brown silty clay loam; breaks into fine nuciform aggregates; medium to strongly acid.
16 to 32 inches, mottled gray, yellow, and brown silty clay loam to sandy clay loam; well-developed nuciform aggregates are coarse to very coarse; medium to strongly acid.
32 to 48 inches, mottled yellow, gray, and brown stratified layers of sand and silt with which occurs an occasional layer of clay or fine gravel; medium acid in upper part but grades with depth to slightly acid.
48 inches +, mottled light-gray, pale-yellow, and brown stratified calcareous sand and silt with some clay and some gravel.

The thickness of the dark surface and subsurface layers varies from 10 to 15 inches. The texture of the subsoil is somewhat variable, depending upon the sequence in which the layers of differently textured materials were deposited. The thickness and sequence of the lower subsoil and underlying material are distinctly variable. The material below a depth of 30 inches is heavy calcareous clay in some areas, particularly in those areas in the eastern part of the Iroquois Lake Plain that are associated with Strole and Julian soils. The underlying material is in some places a calcareous glacial till, especially along the northern and southern boundaries of the Iroquois Lake Plain area where this soil grades to the Odell soils.

Use and management.—Darroch silt loam is highly productive of all the common farm crops grown in the area, and yields are relatively high. Rotations in common use are (1) corn, soybeans, and oats with an intercrop of sweetclover and (2) corn followed by oats with an intercrop of sweetclover. These rotations are altered occasionally to include wheat and hay crops, principally alfalfa or a mixture of alfalfa, clover, and timothy. Artificial drainage is necessary for successful crop production and has been accomplished in most areas. Heaving damages fall-sown small grains to some extent, and all small grains are injured somewhat by lodging. The new stiffer strawed varieties of oats will partly reduce the loss resulting from lodging.

The common practice is to use commercial fertilizer with corn, oats, and wheat, but it is usually not applied directly to soybeans. Hay crops, as alfalfa and clover, or a mixture of these and grasses, are well suited and produce good yields. Unless they have been limed previously, most areas need some lime for the most successful growth of either clover or alfalfa. Some areas are in permanent bluegrass pasture of good to excellent quality, and a few of these need additions of lime and commercial fertilizer, especially phosphate.

Deardurff fine sandy loam (Dd).—This soil has developed on relatively thin deposits of sandy material laid over light-textured calcareous glacial till of Late Wisconsin age. It occurs on nearly level

to very gently undulating relief (0 to 2 percent) and is closely associated with Parr and Ayr soils, principally on the Marseilles moraine. Surface runoff is low and internal drainage is moderate to rapid. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, dark brownish-gray to very dark brownish-gray loose fine sandy loam; relatively high organic content; slightly to medium acid.
8 to 12 inches, dark-gray to very dark-gray loose fine sandy loam; organic content somewhat lower than in the layer above; medium acid.
12 to 22 inches, yellowish-brown to pale-yellow slightly coherent fine sandy loam; medium acid.
22 to 30 inches, pale-yellow, mottled with brown and gray, sandy loam; weakly coherent in place; medium acid.
30 to 50 inches, mottled yellow, brown, and gray sandy clay loam to clay loam; content of sand is somewhat higher in the upper part than in the lower; breaks into weakly developed coarse nuciform aggregates; medium acid in the upper part and gradually becomes slightly acid in the lower.
50 inches +, mottled gray and yellow calcareous loam to light clay loam unassorted glacial till.

The thickness of the dark surface and upper subsoil layers varies from 10 to 18 inches; the depth to mottling, from 18 to 25 inches; and the thickness of the sandy material, from 28 to 40 inches. Where this soil grades to Ayr fine sandy loam soils, the depth to mottling is greater than normal.

Use and management.—Deardruff fine sandy loam occurs in relatively small irregular-shaped areas and is necessarily cropped in the same way as the soils with which it is associated. The principal crops are corn, soybeans, oats, and hay, including alfalfa grown alone or a mixture of alfalfa, clover, and grasses. The soil is somewhat droughty for oats, corn, and soybeans, especially in seasons of abnormally low moisture. It is probably better suited to alfalfa than to other hay crops. The crop yields are only medium.

Liming is usually necessary in growing alfalfa, and additions of organic matter and the liberal use of commercial fertilizers are required to maintain crop production. To maintain and increase productivity and to prevent wind erosion, the rotations should include a large proportion of hay crops and a smaller one of clean-cultivated crops.

Della silty clay loam (De).—This soil has developed on calcareous stratified layers of silt, sand, and clay with some fine gravel. It is the very poorly drained very dark member of the soil catena that also includes the well-drained Jasper, moderately well drained Foresman, imperfectly drained Darroch, and very poorly drained Rensselaer soils. It occurs in close association with the soils in the catena, especially with the Rensselaer, on depressional areas or depressed flats having 0- to 2-percent gradient. Surface runoff is very low, and most of the areas were ponded the greater part of each year under natural drainage conditions. In most areas artificial drainage is sufficient to permit cropping, but some areas need more adequate drainage. Artificial drainage is usually rather easily accomplished where outlets are available, but exceptions to this are in the areas where the lower subsoil and underlying material are predominantly heavy clay. In such places the tile lines need to be close together for effective drainage. Internal drainage is slow. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray to nearly black granular silty clay loam; organic content is very high; a 2- or 3-inch layer of mucky material on the surface in some areas; neutral to slightly acid.
8 to 24 inches, very dark-gray silty clay loam to sandy clay loam; organic content is relatively high although it decreases slightly in lower part; lower 2 or 3 inches is slightly mottled with light gray; breaks into coarse granules in upper part, and there is a gradual change to fine to medium blocky aggregates in the lower; neutral.
24 to 36 inches, light-gray to gray sandy clay loam to silty clay; breaks into very coarse blocky aggregates, plastic when moist and hard when dry; lower part of layer shows a few pale-yellow mottles and blotches; thin layers or seams of fine and very fine sand are present in some areas; neutral.
36 to 50 inches, mottled gray, yellow, and brown roughly stratified layers of silt, sand, and clay with some fine gravel; neutral.
50 inches +, stratified layers of calcareous silt, sand, and clay with an occasional layer of fine gravel.

The total thickness of the dark surface and upper subsoil layers ranges from 18 to about 28 inches. Below a depth of about 24 inches the texture of the material is decidedly variable because the various layers change in thickness and sequence in short horizontal distances and between areas. Included with this soil are a few small areas having a silt loam surface texture. The subsoil and underlying material in most of these included areas is somewhat lighter textured. Where this soil is associated with Julian silty clay loam, the material below a depth of about 24 to 30 inches is in many cases calcareous heavy clay. Because of the lack of uniformity in the deposited material on which this soil developed, the material below a depth of 30 inches is in a few areas sandy loam or fine sand.

Use and management.—Because Della silty clay loam occurs in close association with Rensselaer and Darroch soils and in some instances with Julian, the rotations and management practices are governed largely by the extent of the associated soils. All of the principal field crops are grown, although corn, soybeans, and oats predominate. All crops may be damaged in seasons of high moisture, and some loss in yield of wheat and oats results from heaving and from lodging of the grain.

Adequate artificial drainage is necessary for successful crop growth. If drainage has not been well established there is considerable loss from drowning-out of crops, especially fall-sown small grains and hay. The stiffer strawed varieties of wheat and oats, especially of oats, have reduced the loss from lodging considerably. Alfalfa and clover are fairly well suited where artificial drainage is adequate, but some loss may be caused by drowning-out and heaving.

Dillon fine sandy loam (Dr).—This soil is the very poorly drained very dark member of the soil catena that also includes the closely associated excessively drained Plainfield, moderately well drained Berrien, imperfectly drained Morocco, and very poorly drained dark Newton soils. It occupies glaciofluvial outwash and lake plains and is developed on loose acid sand. Relief is nearly level (0 to 2 percent), and the areas are in many places on broad depressed flats, principally in the Kankakee Lake Plain. Surface runoff is very low, and most of the areas were under water a considerable part of each year when natural drainage conditions prevailed. Most of the areas have been artificially drained to an extent sufficient to permit cropping, but a

considerable acreage needs more adequate drainage. The areas in need of better drainage are shown on the soil map by marsh symbol. After the water table has been lowered, the internal drainage, or movement of water through the soil, is very rapid. The native vegetation was principally marsh grasses, with a later encroachment of water-tolerant trees.

Profile in a cultivated area:

0 to 8 inches, very dark-gray loose fine sandy loam; organic content is high and on many undisturbed areas there is a 2- or 3-inch layer of muck; strongly to very strongly acid.

8 to 22 inches, very dark-gray to dark-gray loose loamy fine sand; organic content relatively high but diminishes somewhat with depth; strongly to very strongly acid.

22 to 36 inches, gray to light-gray loose fine sand; strongly to very strongly acid.

36 to 80 inches +, light-gray, mottled with pale-yellow, loose fine sand to sand; mottlings usually increase with depth; material is strongly to very strongly acid in the upper part and with a gradual change becomes medium or slightly acid below a depth of 70 to 80 inches.

The thickness of the dark surface and upper subsoil layers ranges from 16 to 28 inches, and the organic content in these is somewhat variable. The subsoil in a few areas is yellow instead of gray. Where this soil grades to Granby and Maumee soils there is a gradual change from very strongly acid to medium or slightly acid. The boundaries in these instances are somewhat arbitrarily drawn. In places where there is a gradual gradation from this soil to Newton fine sandy loam, the thickness of the dark layer gradually diminishes.

Use and management.—Where drainage is adequate, much of Dillon fine sandy loam is cultivated to corn, oats, and soybeans, and some areas are in wheat or hay. Crop yields are relatively low. The strong acidity of the entire profile apparently affects the availability of plant nutrients. A considerable acreage is in woods or woodland pasture of fair to poor quality. Where artificial drainage is not adequate for crop production, much of the soil is in permanent bluegrass pasture with which there is mixed some natural marshland vegetation.

Dillon loamy fine sand (Dg).—This soil has developed on loose acid sand of the glaciofluvial outwash and lake plains. It occupies 0- to 2-percent slopes on the deeper depressional areas and broad depressed flats and occurs principally in the Kankakee Lake Plain area, where it is associated with the Newton, Morocco, Berrien, Granby, and Maumee soils. Surface runoff is very low, and when natural drainage conditions prevailed, most of the areas were under water a large part of each year. A considerable part of the soil has been artificially drained to an extent sufficient for crop production. Some areas are still undrained and are shown on the map by a marsh symbol. Where outlets are available, drainage is easily established by lowering the water table of the area. After drainage has been installed, or after the water table has been lowered, movement of moisture through the soil profile is very rapid. The native vegetation was mainly marsh grasses, although there was an encroachment of water-tolerant trees in some places.

Profile in a cultivated area:

0 to 8 inches, very dark-gray loose loamy fine sand; relatively high organic content; light-gray and dark-gray appearance when dry, as the light-gray quartz sand grains then contrast with dark organic matter; strongly to very strongly acid.

8 to 22 inches, dark-gray to very dark-gray loose loamy fine sand; organic content lower than in layer above and diminishes somewhat with depth; strongly to very strongly acid.
22 to 35 inches, light-gray loose fine sand to sand with an occasional faint yellow mottling; strongly to very strongly acid.
35 to 80 inches +, light-gray mottled with yellow loose fine sand to sand; material is strongly to very strongly acid to a depth of 70 to 80 inches and below that depth gradually changes to medium or slightly acid.

The total thickness of the dark surface and upper subsoil layers varies from 18 to 26 inches, and the organic content is also somewhat variable. Where this soil grades to Houghton loamy muck over sand, the organic content of the surface soil is considerably higher than normal. The organic content and total thickness of the surface and upper subsoil are less than normal where this soil grades to Newton soils. Where there is an occasional gradual change from this soil to Granby and Maumee soils, the reaction changes gradually from very strongly acid to medium or slightly acid. The boundaries between this soil and the Granby and Maumee are in some instances arbitrarily drawn.

Use and management.—The principal crops grown on Dillon loamy fine sand are corn, soybeans, and oats. Some wheat and hay are also produced. The productivity of most crops is low. The strong acidity of the entire profile prevents plants from obtaining nutrients or reduces their availability. Wind erosion may be somewhat severe on clean-cultivated areas. The areas lacking artificial drainage are now in low-grade pasture consisting of bluegrass and natural marshland vegetation.

Edwards muck (Eb).—Shallow deposits of black or brownish-black muck underlain by gray marl form this soil. Natural drainage is very poor and water formerly stood on most of the areas, but part of the soil has been drained to an extent that will permit cultivation or the successful growing of bluegrass. The slope range is 0 to 2 percent.

Profile description:

0 to 8 inches, brownish-black to black fine granular muck; mildly alkaline to calcareous.
8 to 20 inches, black, brownish-black, or brown coarse granular muck; mildly alkaline to calcareous.
20 inches +, light-gray or gray calcareous marl containing many small shells and some partly decomposed plant remains; rather soft, especially when wet.

Use and management.—The areas of Edwards muck under cultivation are in corn, soybeans, and small grains. The crop yields are lower than those obtained on Houghton muck. Some areas are too alkaline for the most successful growth of crops, especially for potatoes, as the alkalinity encourages potato-scab disease. Much of the soil is in permanent bluegrass pasture of good to excellent quality.

Edwards muck, burned phase (Ec).—This soil consists of areas, formerly of Edwards muck, from which the organic matter has been burned. The slope range is 0 to 2 percent. The present surface material, to a depth varying from 6 to 14 inches, is reddish-brown or yellow loamy material and consists principally of the residue, or ashes, from the burning of the muck. This residue rests on gray marl. The removal of the muck by burning has so much lowered the surface level in relation to the water table that most areas are too

wet to permit cultivation. Attempts are made to cultivate a few small areas, but because the crops grow largely in the calcareous marly material, the yields are low. The marl is suitable for correcting soil acidity and is being used to replace limestone for that purpose.

Edwards loamy muck (Ea).—In content of muck and mineral material this soil is intermediate between Edwards muck and Maumee soils. It occurs in many places as a transitional soil. Slopes range from 0 to 2 percent. The 12- to 24-inch surface soil is very dark-gray to very dark brownish-gray loamy muck relatively high in content of organic matter. The content of organic matter usually ranges between 30 and 50 percent but decreases with depth, whereas the content of mineral material increases. Below this surface layer is gray calcareous marl. The surface and subsoil are mildly alkaline to calcareous.

Use and management.—Corn, soybeans, and wheat are the principal crops grown on Edwards loamy muck. The yields are somewhat lower than those obtained on Maumee fine sandy loam, as this soil is somewhat too alkaline for successful growth of most crops. Some wind erosion occurs, especially on clean-cultivated areas. Excellent stands of bluegrass pasture can be maintained.

Foresman fine sandy loam (Fa).—This soil has developed on calcareous stratified layers of sand and silt with some layers of clay and fine gravel. It occupies lake plains and glaciofluvial outwash and is the moderately well drained member of the soil catena that also includes the well-drained Jasper, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained very dark Della soils. Relief is nearly level, the slope range being 0 to 2 percent. Surface runoff is low; internal drainage is moderate in the upper part and somewhat restricted in the lower. Artificial drainage is not necessary for crop production. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown to dark brownish-gray loose fine sandy loam; relatively high organic content; slightly to medium acid.
8 to 15 inches, dark grayish-brown to dark brownish-gray friable heavy sandy loam; organic content relatively high in the upper part but gradually diminishes with depth; medium to strongly acid.
15 to 22 inches, light-brown to pale-yellow light clay loam; friable; medium to strongly acid.
22 to 32 inches, yellow, mottled with gray and brown, clay loam; occasional thin layer or seam of very fine sand; medium to strongly acid.
32 to 54 inches, mottled gray, yellow, and brown stratified layers of sand and silt with some clay and some fine gravel; the thickness and sequence of each layer of differently textured material is decidedly variable; upper part is medium to strongly acid but there is a gradual change to slightly acid in the lower part.
54 inches +, calcareous stratified layers of sand and silt with some clay and fine gravel.

The thickness of the dark surface and subsurface layers varies between the approximate limits of 10 and 18 inches. The organic content of these layers is also variable. The texture of the subsoil and the thickness and sequence of the stratified material vary greatly from place to place. The subsoil below a depth of 30 inches is a loose sand in some places. In a few areas the underlying material below a depth of about 40 inches is calcareous clay.

Use and management.—General farm crops, including corn, oats, soybeans, wheat, and hay, are grown on Foresman fine sandy loam, but corn, soybeans, and oats predominate. Because the soil often occurs in areas of irregular size and shape that are closely associated with other Foresman soils and with those of the Jasper, Darroch, and Rensselaer series, the rotations and management practices used are influenced somewhat by the associated soils. Crop yields are usually somewhat lower than those obtained on Foresman loam and silt loam. Crops, especially oats, are somewhat injured by the droughtiness of the soil in summer and early in fall. The soil is well suited to alfalfa, but in most areas liming and fertilizing are needed to secure better stands.

Foresman loam (FB).—This soil has developed on calcareous stratified layers of silt and sand with some clay and some gravel. It is the moderately well drained member of the soil catena that includes the well-drained Jasper, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained very dark Della soils. Relief is nearly level; slopes range from 0 to about 2 percent. Surface runoff is low; internal drainage is moderate in the upper part and slow in the lower. The susceptibility to erosion under clean cultivation is low. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to very dark brownish-gray friable granular loam; relatively high organic content; slightly to medium acid.

7 to 15 inches, dark grayish-brown friable heavy loam of coarse granular structure; organic content relatively high in the upper part but decreases with depth; medium to strongly acid.

15 to 22 inches, pale-yellow to light brownish-yellow silty clay loam; breaks into fine nuciform aggregates and the upper inch or two is slightly darkened by penetration of organic material from the layer above; medium to strongly acid.

22 to 32 inches, mottled yellow, brown, and gray clay loam to silty clay loam; breaks into coarse or very coarse nuciform aggregates; contains an occasional thin seam of fine sand; medium to strongly acid.

32 to 52 inches, pale-yellow, mottled with gray and brown, somewhat stratified layers of sand, silt, clay, and some fine gravel; thickness and sequence of the various stratified layers markedly variable within short horizontal distances and between areas; upper part is medium to strongly acid and there is a gradual change to slightly acid in the lower.

52 inches +, calcareous stratified layers of sand, silt, clay, and some gravel; pale yellow mottled with brown and gray, the yellowish color predominating.

The total thickness of the dark surface and subsurface layers ranges from about 11 to 18 inches, and the organic content is somewhat variable. The depth to the stratified material varies from 27 to 36 inches; the depth to calcareous material, from about 45 to 60 inches or more. In some places the underlying calcareous material is unassorted glacial till instead of the stratified material. In those areas of Iroquois and northern Grant Townships where this soil occurs in association with Strole and Julian soils, the underlying material is dominantly heavy plastic calcareous clay.

Use and management.—Foresman loam occurs in close association with Jasper, Darroch, and Rensselaer soils, and crop rotations and management practices are usually governed by the proportion of those soils. The rotation in common use is corn, soybeans, and oats with an intercrop of sweetclover. Another rotation is 1 year of corn followed

by 1 year of oats and an intercrop of sweetclover. These rotations are altered to include an occasional wheat crop and some hay, particularly alfalfa or a mixture of alfalfa, clover, and timothy. Grain and hay crops are well suited and produce relatively high yields.

Application of lime is usually necessary for the successful growth of alfalfa or clover. Commercial fertilizer is usually applied for all the common crops except soybeans. Although some commercial fertilizer is used directly with soybeans, the more common practice is to fertilize the preceding crop rather heavily. The soybeans benefit from the residual effect of this large application. A few small areas of this soil are in permanent bluegrass pasture. The livestock carrying capacity is usually relatively high, but it could be increased considerably in some areas by the use of lime and commercial fertilizer.

Foresman silt loam (Fc).—Stratified layers of calcareous sand and silt with some clay and some gravel are the materials on which this soil developed. It is the moderately well drained member of the soil catena that also includes the well-drained Jasper, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained Della soils. The areas of this soil are irregular in size and shape and occur in close association with Jasper, Darroch, and Rensselaer soils on relief of 0 to 2 percent. Surface runoff is low, and internal drainage is moderate in the upper part and somewhat slow in the lower. Artificial drainage is necessary for only a few crops. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown to very dark grayish-brown friable granular silt loam; relatively high organic content; slightly to medium acid.

8 to 16 inches, dark grayish-brown to dark brownish-gray heavy silt loam containing some gritty material; organic content relatively high in the upper part but diminishes with depth; structure is coarse granular to fine nuciform; medium acid.

16 to 22 inches, pale-yellow to light brownish-yellow clay loam to silty clay loam; breaks into coarse to very coarse nuciform aggregates and is slightly plastic when moist and hard when dry; upper inch or two of layer shows some slight darkening because of penetration of organic matter from the layer above; medium to strongly acid.

22 to 32 inches, mottled yellow, gray, and brown sandy clay loam to silty clay loam; structure about the same as in the layer above; medium to strongly acid.

32 to 50 inches, mottled yellow, gray, and brown stratified layers of sand, silt, clay, and some fine gravel; thickness and sequence of various layers is decidedly variable, but the silt predominates; upper part of horizon strongly to medium acid, with gradual change to slightly acid in the lower.

50 inches +, yellow mottled with gray and brown calcareous stratified layers of silt, sand, and clay and an occasional layer of fine gravel; in thickness and sequence the various layers are variable, but the silt predominates.

The total thickness of the dark surface and subsurface layers varies from 12 to 18 inches, and the organic content of both is also somewhat variable. The underlying material in a few areas is dominantly clay instead of stratified layers of sand, silt, and clay. The clay texture is especially evident where this soil is closely associated with the Strole and Julian series.

Use and management.—All the common crops of the area are grown on Foresman silt loam, but corn, soybeans, and oats predominate.

The rotations in common use are (1) corn, soybeans, and oats with an intercrop of sweetclover or (2) 1 year of corn and 1 year of oats with an intercrop of sweetclover. Rotations are sometimes altered to include an occasional wheat crop or hay crops of alfalfa or of a mixture of alfalfa, clover, and timothy. This soil is well suited to these grain and hay crops, and yields are relatively high. The surface soil is high in content of organic matter that seems to be durable under intense cultivation. Some areas are in permanent bluegrass pasture of good to excellent quality. A few pastures could be improved by liming, fertilizing, and controlling weeds.

Granby fine sandy loam (GA).—This soil has developed on calcareous loose sand of the glaciofluvial outwash plains and lake plains. The material is similar to that on which the Maumee soils are developed, but this soil differs from the Maumee in having thinner dark-colored surface and upper subsoil layers that are lower in organic content. It occurs principally in association with Maumee, Newton, and Dillon soils on a relief of 0 to 2 percent. It usually occupies broad depressed flats in the Kankakee Lake Plain area. Surface runoff is very low, and the greater part of the areas were ponded when natural drainage prevailed. Artificial drainage has been installed in most areas, but a few still need more adequate drainage. After the water table has been lowered, the movement of water through the soil profile is rapid to very rapid. The native vegetation was mainly marsh grasses, but there was some encroachment of water-tolerant trees.

Profile in a cultivated area:

0 to 8 inches, very dark-gray to very dark brownish-gray loose fine sandy loam; relatively high organic content; slightly acid to neutral.
8 to 14 inches, dark-gray loose fine sandy loam somewhat lower in organic content than the layer above; slightly acid to neutral.
14 to 40 inches, mottled light-gray and yellow loose loamy fine sand to fine sand; slightly acid to neutral.
40 inches +, mottled gray and yellow loose calcareous fine sand to sand.

Where this soil grades to Maumee fine sandy loam its surface soil is darker and the total thickness of the dark surface and upper subsoil layers is greater than normal. Where there is a gradual gradation from this soil to Newton or Dillon soils, there is a gradual change from slightly acid to very strongly acid. The boundaries in such areas of transition are arbitrarily drawn.

Use and management.—Corn, soybeans, and oats are the principal crops grown on Granby fine sandy loam, but wheat and hay are occasionally grown. Yields are fair to good. The organic content and nitrogen supply are fairly high, but the supply of phosphate and potash is usually relatively low, and additions of commercial fertilizer high in those elements are necessary for good crop yields. Some areas are somewhat droughty, especially in seasons of abnormally low moisture and in areas where the water table has been lowered considerably. There is some danger to small plants from wind erosion, especially under clean cultivation. A few areas are in permanent bluegrass pasture of fair to good quality. The addition of fertilizer high in phosphate and potash would improve the livestock carrying capacity of most pasture.

Granby fine sandy loam, mucky subsoil phase (GB).—A higher content of organic matter in the surface soil, a layer of mucky ma-

terial in the upper subsoil, and the slightly alkaline to calcareous nature of the surface and upper subsoil differentiate this soil from Granby fine sandy loam. The one large area of this soil occurs in association with the mucky subsoil phase of Maumee fine sandy loam in a part of the old Beaver Lake bed. The range in slope, natural drainage conditions, surface runoff, and permeability are about the same as for Granby fine sandy loam.

Profile in a cultivated area:

0 to 8 inches, very dark-gray loose fine sandy loam; organic content relatively high and somewhat higher than in Granby fine sandy loam; neutral to slightly alkaline.

8 to 11 inches, dark-gray fine sandy loam slightly compact in place but easily broken up; organic content somewhat lower than in layer above; neutral to slightly alkaline.

11 to 19 inches, very dark brownish-gray colloidal rather firm and feltlike muck; breaks into thin flakes or platy pieces ¼ to ½ inch thick and 3 or 4 inches long; a few very thin seams of fine sand separate the various layers; mildly alkaline.

19 to 70 inches +, grayish-yellow, mottled with light-gray and brown, calcareous loose fine sand to sand.

The total thickness of the first two layers varies from 7 to 14 inches. The thickness of the colloidal muck layer varies from 4 to 12 inches. In areas where the surface soil has been plowed to the greater depths a part of the muck layer is mixed through the entire plow layer.

Use and management.—Granby fine sandy loam, mucky subsoil phase, is practically all cultivated, principally to corn, soybeans, and oats. Some wheat and hay crops are also grown. The supply of organic matter and nitrogen seems fairly high, but the soil is deficient in potash and phosphate. Most farmers formerly made heavy applications of fertilizer high in phosphate and potash, as one with an analysis of 0–8–24,[5] but in recent years there has been more tendency toward use of a complete fertilizer, as one with an analysis of 3–12–12. This soil is more productive than Granby fine sandy loam. There is some danger of damage to oats from lodging of the grain, but the newer stiffer strawed varieties will no doubt reduce this loss somewhat.

Granby loamy fine sand (Gc).—This very poorly drained soil has developed on loose calcareous sand of the glaciofluvial outwash plains and lake plains. The slope range is 0 to 2 percent. It is similar to Granby fine sandy loam in drainage, organic content, and permeability but differs from that soil in having surface and upper subsoil layers of loamy fine sand. Boundaries between these soils are in some instances arbitrarily drawn as there is, in many places, a very gradual change in surface texture.

The surface 8 inches is very dark-gray to dark brownish-gray loose loamy fine sand. When dry the light-gray quartz sand grains stand out in contrast with the dark-gray organic material. The thickness of the dark layers varies from 8 to about 15 inches. Where this soil grades to Houghton loamy muck over sand, the organic content of the surface soil is higher than normal.

Use and management.—Granby loamy fine sand is subject to wind erosion under clean cultivation, and young plants are occasionally

[5] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

damaged by the shifting sand. Corn, soybeans, and oats are the principal crops, but some wheat and hay are also grown. The soil is not so well suited to these crops as Granby fine sandy loam, and crop yields are somewhat lower.

Gravel and sand pits.—This unit consists of areas where sand or gravel, or both, have been removed for various industrial purposes and road building. The pits vary considerably in size and depth, and water stands in a few of them. Gravel pits are located in areas of Stockwell soils, and sand pits are in areas of Plainfield, Coloma, and other sandy soils.

Griffin fine sandy loam (GD).—This soil differs from Griffin loam principally in having a fine sandy loam surface soil and subsoil and in containing a greater quantity of sandy material in the lower subsoil. It occurs on the flood plains of the Kankakee River. Many areas are somewhat inaccessible unless one or more bridges are constructed, and therefore only a very small part is under cultivation. If the areas were adequately protected from flooding and were not so much cut up by the old river channels, a much larger acreage probably would be under cultivation. Fair to good yields of corn, soybeans, and oats can be obtained, but the crops are now subject to severe loss from flooding. Practically all the soil is in woodland pasture.

Griffin loam (GE).—This alluvial soil occurs on the flood plain of the Kankakee River. The straightening of the river channel left numerous old abandoned channels, many of which cannot be crossed. In places the soil occurs in small areas of irregular size and shape, and these are inaccessible unless bridges are built across the old channels. The soil is subject to periodic flooding, and most of the areas are inundated at least once each year. The slope range is 0 to 2 percent.

Profile description:

0 to 4 inches, medium dark-gray friable loam with a faint yellowish hue; medium to low organic content; slightly acid.
4 to 15 inches, yellowish-gray loam highly mottled and blotched with yellow and brown; mottling increases with depth and is conspicuous; slightly acid to neutral.
15 to 40 inches +, mottled yellow, gray, and brown loam, sandy loam, or sandy clay loam; the yellow occurs as large blotches or streaks; neutral.

Under cultivation the first layer and part of the second are mixed and the resulting surface soil is brownish gray or yellowish gray. The yellow blotching and mottling is conspicuous throughout the soil and is evident in the surface soil in some areas. The texture of the subsoil is variable below depths of 15 inches, and partly decomposed branches, leaves, and other vegetative material are conspicuous.

Use and management.—Only a small part of Griffin loam, probably less than 5 percent, is now under cultivation. The danger of flooding and the presence of numerous old channels, many of which are partly filled with water, limit cultivation. Corn, soybeans, and oats are the principal crops. Fair to good yields of corn and soybeans are obtained, but there is some loss to oats from drowning-out. The soil is largely in timber or timbered pasture.

Griffin loamy fine sand (GF).—The conspicuous yellow blotching and mottlings present in other Griffin soils occur in this soil, but the

profile is much lighter textured throughout. The surface soil is brownish-gray loose loamy fine sand with yellow mottlings and blotches and is underlain by gray loose loamy fine sand to fine sand, highly blotched and mottled with yellow and brown. Relief ranges from 0 to 2 percent.

Use and management.—Practically all areas of Griffin loamy fine sand are now under a timber cover or are idle and support a variable but usually sparse growth of grass and weeds. When cleared of timber and cultivated, the soil is subject to wind erosion. Owing to the sandiness of the surface and subsoil layers, this soil is unproductive of the field crops common to the area.

Hagener fine sandy loam, undulating phase (HA).—This soil differs from the undulating phase of Hagener fine sand, in having a fine sandy loam surface soil slightly higher in organic content and an upper subsoil that contains enough fine-textured material to be feebly coherent. The surface 6 to 8 inches is dark grayish-brown to dark brownish-gray fine sandy loam relatively high in organic content. The subsoil, to a depth of about 20 inches, is dark-brown to dark grayish-brown feebly coherent fine sandy loam. Underlying this layer is loose brown or brownish-yellow loamy fine sand to fine sand. This soil occurs in association with other Hagener soils and with the Jasper and Foresman. Included are a few small areas where a part of the surface soil and in some places part of the subsoil have been removed by the wind.

Use and management.—The areas of Hagener fine sandy loam, undulating phase, are usually small and are cropped about the same way as the associated soils. Crop yields are intermediate between those obtained on the undulating phase of Hagener loamy fine sand and those produced on Jasper fine sandy loam soils. The soil is droughty and subject to wind erosion under clean cultivation. It is not so well suited to corn, soybeans, and oats as the heavier textured associated soils.

Hagener loamy fine sand, undulating phase (HB).—Loose noncalcareous sand is the material from which this prairie soil developed. It occurs on slopes of 0 to 5 percent and has been affected only slightly by wind erosion. Surface runoff is very low and internal drainage is very rapid. The soil usually occurs as narrow low dunes and is associated principally with Jasper and Foresman soils. The native vegetation was prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to very dark grayish-brown loose loamy fine sand; relatively high organic content; material contains only enough silt and clay to hold the sand grains together rather feebly when moist; slightly to medium acid.

7 to 14 inches, dark grayish-brown loose loamy fine sand; somewhat lower in organic content and somewhat looser than the layer above; slightly to medium acid.

14 to 20 inches, moderately dark grayish-brown to dark-brown loose loamy fine sand; content of organic matter is just sufficient to darken the material somewhat; medium acid.

20 to 60 inches +, yellowish-brown to brownish-yellow loose loamy fine sand to fine sand; becomes somewhat more yellow with depth; medium acid.

The total thickness of the dark surface and upper subsoil layers varies from 15 to 25 inches or more. The total thickness of the sandy material is markedly variable but usually more than 6 feet. Included with this

soil is one relatively small area in the extreme northwestern part of Jefferson Township having lighter colored surface soil than normal. The organic content in this area is considerably lower, and probably it is an area where trees have encroached upon the prairie vegetation.

Use and management.—The greater part of Hagener loamy fine sand, undulating phase, is cultivated to corn, soybeans, wheat, oats, and some hay crops. Because it occurs as long irregular-shaped dunelike areas closely associated with other soils, a field rarely consists largely or entirely of this soil, and rotations and management practices are therefore governed somewhat by the extent of the associated soils. Owing to the association of soils, crops may be grown that are economically unprofitable on this one.

If liberal quantities of barnyard manure and green manure are plowed under, sufficient lime is used, and liberal quantities of commercial fertilizer are applied throughout the rotations, fair to good yields can be obtained in seasons of relatively high rainfall. Yields are considerably reduced during seasons of low moisture supply. The soil is probably better suited to wheat than to oats, and alfalfa is better suited than clover. Alfalfa will aid in controlling wind erosion.

Hagener loamy fine sand, wind-eroded rolling phase (Hc).—This soil occurs on slopes of 5 to 12 percent or more, and 50 percent or more of the surface soil and a part of the subsoil have been removed by wind erosion. It is closely associated with the undulating phase and includes the more steeply sloping parts of the dunelike areas on which Hagener soils usually occur. Blow-outs, or areas where the wind has removed the surface and subsoil to depths of 3 to 5 feet or more, occur in some places. The organic content of the surface soil is considerably lower than in the undulating phase, and this phase is more droughty.

Use and management.—Except for areas where blow-outs occur, most of Hagener loamy fine sand, wind-eroded rolling phase, is used for general farm crops. Yields are very low. The soil is very susceptible to wind erosion under clean cultivation, and in large part the rotations should be composed of close-growing crops. One of the best crops for this soil is alfalfa. For successful growing of alfalfa it is usually necessary to apply lime, and large quantities of commercial fertilizer should be used. The soil is not well suited to permanent bluegrass pasture. The continuous trampling of livestock, especially of cattle, tends to destroy the grass, and the droughtiness of the soil in summer and early in fall reduces the livestock carrying capacity.

Houghton loamy muck over sand (Hd).—This soil may be considered transitional from Houghton muck to the dark very poorly drained mineral soils, as the Maumee and Granby, especially Maumee fine sandy loam or loamy fine sand. The proportion of organic matter increases and the content of mineral matter decreases as the areas of muck are approached. The surface 8 inches is very dark brownish-gray to nearly black loamy muck containing considerable fine sand and loamy material. It is underlain by very dark-gray loamy muck or sandy muck in which the content of organic matter decreases and the content of sand and other mineral matter increases

as depth becomes greater. At a depth of 14 to 36 inches is loose gray sand.

Use and management.—The size of the individual areas and the extent of the associated soils often govern the use of Houghton loamy muck over sand. Where it is associated principally with Maumee soils, the crops are corn, soybeans, wheat, and some hay. Where it is associated principally with muck soils, the principal crops may be corn, soybeans, or potatoes. The organic content is higher than in the Maumee soils, and crop yields are somewhat higher than on Maumee fine sandy loam. This soil is subject to wind erosion where it is under clean cultivation. Some areas are in bluegrass pasture.

Houghton muck (He).—Areas of this soil have developed in accumulations of plant remains consisting chiefly of reeds, sedges, and other bog vegetation. There is little or no tree growth. The soil occurs principally on broad depressed areas, many of which were sites of former shallow lakes. Relief ranges from 0 to 2 percent. Practically all areas were under water at least part of each year when natural drainage prevailed, but most of the areas have been artificially drained to an extent sufficient to permit cropping. Open ditches and tile lines are both used. Wind erosion is potentially severe, especially on the larger areas and where windbreaks have not been established.

Profile description:

0 to 8 inches, black somewhat granular muck; extremely high organic content; medium to slightly acid.
8 to 24 inches, black to brownish-black slightly compact muck; breaks into large chunks that are easily broken into coarse granules; medium to slightly acid.
24 to 40 inches, very dark-gray to brown soft mucky and peaty material containing numerous partly decomposed plant remains; medium acid.
40 to 60 inches +, yellow to brownish-yellow soft macerated peaty material composed of partly decomposed plant remains.

The black or brownish-black material varies from 14 to 30 inches thick. In total thickness the organic material is somewhat variable, and it is usually underlain by sand or glacial till.

Use and management.—The organic content and nitrogen supply are high in Houghton muck, but the content of available phosphate and potash is low. The use of commercial fertilizer high in content of phosphate and potash is therefore necessary in achieving a balanced supply of nutrients for crops. Corn and potatoes are the principal crops, especially on the larger areas. Small grains are not well suited. A few areas are in soybeans or hay crops. Yields of both corn and potatoes are high, particularly when large applications of commercial fertilizer are used. Some areas are in bluegrass pasture of excellent quality.

Houghton muck, shallow phase over sand (Hg).—This phase differs from the closely associated Houghton muck in being underlain by loose gray sand at a depth of 14 to 36 inches. The surface and upper subsoil layers are not so deep but otherwise are comparable to the corresponding ones of Houghton muck. In many places this muck is transitional between Houghton muck and areas of very poorly drained mineral soils, as the Maumee and Granby.

Use and management.—Corn and potatoes are the principal crops grown on Houghton muck, shallow phase over sand. The water table

has been lowered to such an extent in some areas that the soil is somewhat doughty for both crops. The crop yields are somewhat lower than those obtained on Houghton muck. This phase could be used satisfactorily for the growing of vegetables other than the potatoes now produced, but very little of the acreage is so used.

Houghton muck, burned phase over sand (Hr).—This phase consists of areas, formerly of Houghton muck, on which the organic material has been burned. The surface material, a reddish-brown or yellow loamy residue left from the burning of several feet of muck, is underlain by loose sand at a depth of 6 to about 14 inches. The burning has lowered the surface level to such an extent that practically all areas are poorly drained and in addition has destroyed the supply of organic matter and nitrogen.

Included with this phase are a few areas where the muck has been only partly burned, and in these a few inches of muck and peat material remain over the sand. The surface level of many of the included areas has been lowered so much that drainage is too poor to permit cultivation.

Use and management.—Houghton muck, burned phase over sand, is essentially nonagricultural under present economic conditions. The greater part is now idle and supports a growth of young aspen trees. In areas where drainage permits cultivation, crop yields become low in a few years.

Jasper fine sandy loam, undulating phase (Jb).—The irregular-shaped relatively small areas of this soil occur in many places as a part of low narrow ridges, principally in the Iroquois Lake Plain area. Slopes range from 2 to 5 percent. The soil developed on calcareous stratified layers of fine sand and silt with which there is some clay and gravel. This soil is associated with Foresman soils and in some instances with the Hagener. It is the well-drained member of the soil catena that also includes moderately well drained Foresman, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained very dark Della soils. Surface runoff is medium, and internal drainage is moderate to somewhat rapid. The soil is moderately erosive under clean cultivation. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown loose fine sandy loam; organic content is relatively high but somewhat lower than in the surface soil of Jasper loam and silt loam soils; medium acid.

8 to 15 inches, dark grayish-brown to dark-brown sandy loam slightly heavier than that of the layer above; organic content is relatively high in the upper part and decreases with depth; medium acid.

15 to 30 inches, brown to yellowish-brown light sandy clay loam; friable; medium to strongly acid.

30 to 54 inches, brownish-yellow to yellowish-brown stratified layers of sand and silt with an occasional layer of clay or fine gravel; in thickness and sequence the various layers are decidedly variable within short horizontal distances and from place to place; medium to strongly acid in upper part and grades with depth to slightly acid in the lower part.

54 inches +, calcareous stratified layers of sand and silt with some gravel and clay.

The thickness of the dark surface and subsoil layers varies from 10 to 18 inches. The organic content of both layers is somewhat variable, and in a few areas where erosion has taken place they are dark brown The thickness of the dark surface and subsoil layers varies from 10 to

few areas the material below a depth of 30 inches is loose sand, and in these the profile characteristics approach those of Hagener soils.

Use and management.—The general farm crops of the area are grown on Jasper fine sandy loam, undulating phase, but because of somewhat droughty conditions during summer and early fall, yields of most crops are lower than those obtained on Jasper loam soils. Where practical, the rotation for this soil should be modified somewhat to include a higher proportion of small grains and hay. Although the surface and subsurface layers seem to have an adequate supply of organic matter, increased crop yields will result after organic matter is added in the form of barnyard manure or green-manure crops. Liming is necessary for the successful growth of both clover and alfalfa. Alfalfa is better suited than clover, as it will better withstand the somewhat droughty condition.

Jasper fine sandy loam, eroded sloping phase (JA).—This phase occurs on slopes of 5 to 12 percent or more. Part or all of the surface soil, and in some instances part of the subsoil, has been removed by erosion. The present surface soil is lighter colored and considerably lower in content of organic matter than the undulating phase, and tilth conditions are also poorer.

Use and management.—The proportion of Jasper fine sandy loam, eroded sloping phase, in cultivated crops is about the same as that for the undulating phase, but the soil is less well suited to clean cultivation. Erosion control practices are usually necessary, and the rotation should include a high proportion of small grains and hay. Alfalfa or permanent bluegrass pasture will aid in preventing further erosion, and the soil is probably best used for those crops.

Jasper loam, undulating phase (JE).—This soil has developed on calcareous lake-deposited and outwash-stratified layers of fine sand and silt and occasional layers of clay and gravel. It is the well-drained member of the soil catena that also includes the moderately well drained Foresman, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained dark Della soils. It occurs principally on the Iroquois Lake Plain in relatively small irregularly shaped areas and in many places occupies low narrow ridges that lie slightly higher than the surrounding areas of Foresman, Darroch, and Rensselaer soils. The soil also occurs as low narrow ridges in association with Strole and Julian soils. Relief ranges from 2 to 5 percent. Surface runoff is medium; internal drainage is moderate. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to very dark grayish-brown friable granular loam; high organic content; slightly to medium acid.

7 to 12 inches, dark grayish-brown friable heavy loam; organic content relatively high in the upper part but diminishes with depth; medium acid.

12 to 20 inches, brown or yellowish-brown heavy loam to light sandy clay loam; slightly compact in place but when moist breaks easily into small nuciform aggregates; medium to strongly acid.

20 to 32 inches, brown to brownish-yellow clay loam to silty clay loam; breaks into coarse nuciform aggregates; content of fine sand is variable but usually high; medium to strongly acid.

32 to 50 inches, yellowish-brown to brownish-yellow stratified layers of fine sand, silt, clay loam, clay, and fine gravel, the silt and fine sand predominating; medium acid but grades with depth to slightly acid.

50 inches +, pale-yellow or brownish-yellow calcareous stratified layers of fine sand and silt with which occur occasional layers of clay and gravel.

The thickness of the dark surface and subsurface layers varies from 8 to 16 inches. The texture of the subsoil is somewhat variable to a depth of about 30 inches but is usually heavier than that of the surface soil. In thickness and sequence the stratified layers of sand, silt, clay, and gravel are markedly variable in short horizontal distances and from place to place. In the subsoil and substrata the sand and silt layers usually predominate in occurrence and in thickness. In the eastern part of the lake plain areas where this soil occurs as low ridges in association with Strole and Julian soils, the material below a depth of 40 inches is usually clay. Included with this soil are small areas where the underlying material is calcareous glacial till instead of stratified material.

Use and management.—The crops grown on Jasper loam, undulating phase, are corn, soybeans, oats, wheat, and hay. The more common rotations are (1) corn, soybeans, and oats and (2) corn for 2 years, soybeans for 1 year, and oats with an intercrop of sweetclover. Wheat is occasionally substituted for oats, and some rotations include a hay crop of alfalfa or of mixed alfalfa, clover, timothy, and other grasses. This soil is well suited to these crops, and yields are relatively high.

Although clover and alfalfa are not extensively grown, good yields can be obtained after fertilizer has been applied and the acidity has been corrected by use of lime. Bluegrass pasture is well suited, but most pasture areas could be improved by the use of lime and fertilizer.

Jasper loam, eroded undulating phase (JD).—This phase occurs on slopes of 2 to 5 percent in close association with the other phases of Jasper loam and with Foresman and Darroch soils. Part or all of the surface soil, and in some cases a part of the subsoil, has been removed by erosion. The present surface soil consists in part of material that was formerly subsoil and varies from dark grayish brown to brownish yellow. The rest of the profile is comparable with that of Jasper loam, undulating phase, but tilth is poorer and organic and nitrogen contents are lower.

Use and management.—The rotations in use on Jasper loam, eroded undulating phase, are about the same as those used on the undulating phase of Jasper loam, but crop yields are lower. Where practical, the rotation should be lengthened somewhat to include more small-grain and hay crops and less clean-cultivated crops.

Jasper loam, eroded sloping phase (JC).—This phase occurs on slopes of 5 to 8 percent or more. On most areas a part or all of the surface soil and a part of the subsoil have been removed by erosion. The present surface soil is dark grayish brown to brownish yellow and lower in organic and nitrogen content than the surface soil of the undulating phase, but the rest of the profile is comparable.

Included with this soil are a few small areas where little erosion has occurred. Except for the fact that the layers are somewhat thinner, the profile characteristics of these less eroded areas are similar to those of the undulating phase. A few severely eroded areas are also included, and in these the lighter colored subsoil is exposed. Some of the areas adjacent to the Iroquois River have somewhat

lighter colored surface soils than normal; these represent a transition from Jasper soils, developed under a prairie-grass vegetation, to the Tuscola soils, which developed under forest vegetation.

Use and management.—Erosion is somewhat a problem on areas of Jasper loam, eroded sloping phase, and, where practical, the rotation should consist predominantly of alfalfa or of other hay crops and small grains. Most of the areas adjacent to drainageways are in permanent bluegrass pasture. Probably the soil is best used for pasture or alfalfa, as these crops aid in controlling erosion. Yields of alfalfa hay and the livestock carrying capacity of both alfalfa and bluegrass are high. Most areas need additions of lime and commercial fertilizer for the best growth of these crops.

Jasper silt loam, undulating phase (JH).—This soil has developed on calcareous stratified layers of lacustrine or outwash sand and silt with occasional layers of clay and fine gravel. It is the well-drained member of the soil catena that also includes the moderately well drained Foresman, imperfectly drained Darroch, very poorly drained Rensselaer, and very poorly drained dark Della soils. The soil occurs in close association with others in the catena, but most of the areas are at a slightly higher elevation. Relief ranges from 2 to 5 percent. Surface runoff is medium and internal drainage is moderate. Susceptibility to erosion under clean cultivation is moderate to high. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to dark grayish-brown friable granular silt loam; organic content relatively high and usually higher than in the lighter textured members of the Jasper series; slightly to medium acid.

7 to 16 inches, dark grayish-brown to dark-brown heavy silt loam; organic content relatively high in the upper part but diminishes with depth; structure is coarse granular in the upper part but gradually changes to fine nuciform below; medium acid.

16 to 30 inches, brown to yellowish-brown gritty silty clay loam that breaks into coarse to very coarse nuciform aggregates varying from ½ to 2 inches in diameter; slightly plastic when moist and hard when dry; contains considerable sand; medium to strongly acid.

30 to 50 inches, yellowish-brown to brownish-yellow stratified layers of fine sand, silt, clay, and fine gravel, the layers of sand and silt predominating; in thickness and sequence the various layers are decidedly variable; medium acid in upper part and gradually grades to slightly acid in the lower.

50 inches +, calcareous stratified layers of sand, silt, clay, and fine gravel, the layers of sand and silt predominating.

The thickness of the dark surface and subsurface layers varies from 10 to 18 inches. The organic content of both layers is variable and somewhat lower than normal in those areas adjacent to the Iroquois River. Near the river the color of the surface soil is also lighter than normal. The lower subsoil and underlying material in a few areas are predominantly fine gravel; in others the underlying material is calcareous glacial till instead of stratified material. The occurrence of areas having the glacial till is most frequent along the northern and southern parts of the Iroquois Lake Plain area, where the Jasper soils grade to the Parr.

Use and management.—Jasper silt loam, undulating phase, is well suited to the general farm crops of the area, including corn, soybeans, wheat, oats, and hay. The rotations are usually governed by the

extent of the associated soils. Those in common use are (1) corn for 2 years, soybeans for 1 year, and then oats with an intercrop of sweetclover or (2) corn, oats, and an intercrop of sweet clover. These rotations are modified to include an occasional crop of wheat or of alfalfa or a mixture of alfalfa, clover, and timothy and other grasses.

Corn, oats, and wheat are usually fertilized, but it is uncommon to fertilize soybeans directly. Many farmers apply heavy applications of commercial fertilizer with the crop preceding soybeans and depend upon the residual effect of this application to fertilize the soybeans. The soil is well suited to both alfalfa and clover, but the addition of lime is usually necessary for more successful growth of these crops.

Jasper silt loam, eroded undulating phase (JG).—Slopes for this phase range from 2 to 5 percent. Part or all of the surface soil and in a few places part of the subsoil have been removed by erosion. The present surface soil consists partly of material that was formerly subsoil, and the surface soil is therefore lower in organic content and somewhat lighter colored than the surface soil of the undulating phase. A few severely eroded patches occur, and in these the surface soil is yellowish brown or brownish yellow and consists largely of the former subsoil. In the lower uneroded part the profile is comparable with that of the undulating phase.

Use and management.—Jasper silt loam, eroded undulating phase, occurs in close association with the undulating phase, and management practices and rotations are therefore about the same for both soils. Crop yields, however, are somewhat lower on this eroded soil. To check erosion and improve productivity, the rotation should be lengthened somewhat to include a greater percentage of small grains and hay crops and less of soybeans and corn. Additions of organic matter through use of barnyard manure and green-manure crops, the application of liberal quantities of commercial fertilizer, and liming will improve productivity.

Jasper silt loam, eroded sloping phase (JF).—Only a relatively small total area of this eroded soil is mapped; it occurs as narrow strips adjacent to drainageways. The chief difference between this phase and the eroded undulating phase is in the degree of slope. Slopes for this phase range from 5 to 12 percent. Part or all of the surface soil and in some places a part of the subsoil have been removed by erosion. The surface 6 to 8 inches is dark-brown to yellowish-brown heavy silt loam to light clay loam. The organic content is usually considerably lower than in the undulating phase, but the uneroded part of the profile is comparable.

Included with this phase are a few small areas where only slight surface erosion has occurred. In these areas the profile characteristics, including those of the surface soil, are comparable with those of the undulating phase, but the various layers are somewhat thinner.

Use and management.—The greater part of Jasper silt loam, eroded sloping phase, is now in permanent bluegrass pasture. The pasture is of fair to good quality and could be improved by using lime and commercial fertilizer and by controlling weeds. The areas under cultivation are cropped in about the same way as other phases of Jasper silt loam. The yields are lower than those obtained on the undulating phase.

Julian silty clay loam (JK).—This soil developed on highly calcareous lacustrine clay and occurs principally in the eastern part of the Iroquois Lake Plain area. It is the very poorly drained member of the soil catena that includes the imperfectly drained Strole soils, with which it is closely associated. In some places it is in association with Darroch and Foresman soils. The native vegetation was marsh grasses and tall prairie grasses. Julian soils are Prairie analogs of the Toledo soils, which developed under forest vegetation but are not mapped in this county. Relief ranges from 0 to 2 percent. Surface runoff is very low, and most areas were ponded a considerable part of each year when natural drainage conditions prevailed. Most areas are now artificially drained to an extent sufficient for crop production, but additional drainage is still needed on a considerable part of the soil. Both tile lines and open ditches are used for drainage, although the tile lines predominate. Tile lines need to be closely spaced to be effective because of the heavy-textured and slowly permeable subsoil and underlying material.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to nearly black silty clay loam of coarse granular structure; high organic content; neutral to very slightly acid.
7 to 20 inches, very dark-gray silty clay loam to silty clay; organic content relatively high but decreases slightly with depth; structure is coarse granular in the upper part and grades with depth to fine and blocky; some faint pale-yellow mottlings are in the lower 2 or 3 inches; neutral.
20 to 35 inches, mottled pale-yellow, gray, and brown silty clay to clay; breaks into large blocky aggregates plastic when moist and is very hard when dry; neutral.
35 inches +, mottled light-gray and pale-yellow highly calcareous clay with thin seams or lenses of very fine sand.

The thickness of the dark surface and subsurface soil layers ranges from 16 to 24 inches, and in both the organic content is variable but usually high. The depth to calcareous clay ranges from 28 to 40 inches.

A soil having somewhat different profile characteristics was included with this soil. This inclusion occurs in the west-central part of Colfax Township and in the southeastern part of McClellan Township and has the following profile in cultivated areas:

0 to 7 inches, very dark-gray to nearly black silty clay loam; high organic content; medium granular structure; neutral to slightly acid.
7 to 18 inches, nearly black clay to silty clay that breaks into small blocky aggregates; high organic content; plastic when moist; neutral to slightly acid.
18 to 28 inches, very dark-gray smooth silty clay; contains numerous small specks of brown and dark yellow and many small soft and rounded iron concretions that become hard on drying; breaks into small blocky aggregates; slightly acid.
28 to 54 inches, very dark brownish-gray silty clay to clay; breaks into large blocky aggregates that in many places have weakly defined columns with a vertical dimension of about 4 inches and a horizontal one of about 1¼ inches; slightly acid.
54 to 65 inches, dark-yellow and brown mucky and peaty material occurring in thin plates; slightly acid to neutral.
65 inches +, gray soft marl containing many small light-gray shell particles.

Where this included soil grades to Maumee and other sandy soils, the material below a depth of about 40 inches is loose gray sand.

Use and management.—In many places Darroch and Foresman soils are on slight elevations surrounded by broad depressed areas of Julian silty clay loam. Thus, there is an intricate association, and rotations and management practices are governed somewhat by the associated

soils. Corn, soybeans, and oats are the principal crops, but some areas are occasionally cropped to wheat, and hay crops of alfalfa, clover, and grasses are sometimes used in the rotation. The soil is better suited to corn and soybeans than to small grains, as adequate drainage is difficult to obtain and small grains are apt to be injured from drowning-out and heaving. There is considerable injury to oats from lodging of the grain, but use of the stiffer strawed varieties will tend to reduce this loss. Tilth conditions are not so good as on the Rensselaer soils, and considerable difficulty is experienced in preparing a good seedbed. Alfalfa and clover will both produce good stands without additions of lime, but they may be severely injured by heaving and occasionally by drowning-out in some areas. Some areas are used for bluegrass, which is well suited.

The included soil produces excellent yields of corn and soybeans but is not so well adapted to oats. Rotations of corn for two or more consecutive years, or of corn and soybeans, are in common use on the larger areas. Where drainage is adequate and fertilizer high in phosphate and potash is used, good yields of these crops can be obtained. Most of the smaller areas are in bluegrass pasture.

Kaskaskia silt loam (KA).—This well-drained soil occurs on the alluvial flood plains of the Iroquois River and its small tributaries in association with the Wabash soils. The parent material is alluvium washed from areas of prairie-upland and outwash soils. The greater part of the soil is subject to flooding in variable degree; many areas are inundated at least once each year. Relief ranges from 0 to 2 percent. The native vegetation was a mixture of grasses and bur oak, elm, and associated species.

Profile description:

0 to 6 inches, dark grayish-brown to dark brownish-gray friable silt loam; relatively high organic content; fine to medium crumb structure; slightly to medium acid.

6 to 27 inches, dark grayish-brown to dark-brown friable silt loam to heavy silt loam; organic content is relatively high in the upper part and gradually decreases with depth; medium to coarse granular structure; slightly to medium acid.

27 to 50 inches +, brown friable silt loam to heavy silt loam that breaks into pieces of irregular size and shape; pieces are easily broken down into medium granules; an occasional thin layer of sandy or clayey material; slightly acid.

The total thickness of the first two dark layers varies from 20 to 30 inches. The material below a depth of 30 inches is somewhat variable—rather sandy in some places and clayey in others. Included with this soil are a few small areas on a slightly higher elevation that would have been separated as a high-bottom phase if they had been of sufficient extent. The profile characteristics of the included soil are similar to those of this one, except the subsoil is slightly more acid and has a weakly developed nuciform structure. Most of the included areas are only a few feet above the general level of the alluvial areas, but they are not flooded so often as the first bottoms.

Use and management.—Only about 10 percent of Kaskaskia silt loam is now cultivated. The principal crops are corn and soybeans, but small areas are used for oats, wheat, and hay. The soil is well suited to corn and soybeans because its content of organic matter and nitrogen is relatively high. Corn and soybeans are usually planted

after the greatest danger of flooding is past. Small grains, especially fall-sown ones, are occasionally damaged by floodwaters. The greater part of the land is in permanent bluegrass pasture or forested pasture of good to excellent quality. The included areas occurring at a slightly higher elevation are largely under cultivation and are not flooded so frequently. The crop rotations used on the included soil contain a somewhat higher proportion of small grains.

Kibbie loam (KB).—This soil has developed on calcareous stratified layers of fine sand, silt, and clay with which some fine gravel is mixed. It occupies areas on lake plains and glaciofluvial outwash. It is the imperfectly drained member of the soil catena that also includes the well-drained Tuscola soils, and it occurs in association with those soils on slopes of 0 to 2 percent. Surface runoff is low and internal drainage is slow. Erosion is not a problem.

The surface 6 to 8 inches in cultivated areas is brownish-gray to light brownish-gray friable loam relatively low in organic content. Underlying this is brown or yellowish-brown heavy loam that changes gradually to clay loam at a depth of 9 to 15 inches. At this depth the color changes to mottled gray, yellow, and brown. Below a depth of 30 inches the material is comparable with that of Kibbie silt loam.

There is often a gradual transition from this soil to Darroch soils, with an accompanying gradual increase in the organic content of the surface soil. The surface color in those areas bordering bodies of Darroch soils is therefore considerably darker than normal. In thickness and sequence the layers of sand, silt, and clay in the lower subsoil and underlying material are extremly variable.

Use and management.—The rotations and management practices used on Kibbie loam are about the same as those on Kibbie silt loam. Corn, soybeans, wheat, oats, and hay are the principal crops. Additions of organic matter, liming where necessary, and the liberal use of commercial fertilizer throughout the rotation will help to maintain and increase production. A fairly large part of the rotation should consist of small grains and hay crops. A few areas are in permanent bluegrass pasture, and a few small ones are in forest.

Kibbie silt loam (KC).—This soil has developed on calcareous stratified layers of silt and fine sand with which occur occasional layers of clay and fine gravel. It is the imperfectly drained member of the catena that also includes the associated well-drained Tuscola soils, and it occurs on the Iroquois Lake Plain where forest has encroached upon former prairie areas. Surface relief ranges from 0 to 2 percent. Surface runoff is low and internal drainage is slow. In most areas artificial drainage is necessary for successful crop production. The native vegetation was oak, elm, ash, maple, and associated species.

Profile in a cultivated area:

0 to 7 inches, brownish-gray to light brownish-gray friable silt loam of medium crumb structure; relatively low organic content; slightly to medium acid.

7 to 10 inches, light brownish-gray to pale-yellow heavy silt loam; coarse crumb structure; medium acid.

10 to 15 inches, mottled gray and yellow gritty heavy silt loam to light silty clay loam that breaks into fine nuciform aggregates ¼ to about ¾ inch in diameter; medium to strongly acid.

15 to 32 inches, mottled light-gray, pale-yellow, and light-brown silty clay loam to clay loam; breaks into coarse to very coarse nuciform aggregates; slightly plastic when wet and hard when dry; medium to strongly acid.
32 to 50 inches, mottled gray and yellow stratified layers of silt, sand, and clay with some fine gravel; medium to strongly acid in upper part and gradually changes to slightly acid or neutral in the lower.
50 inches +, gray and pale-yellow stratified layers of calcareous silt, sand, and clay with some fine gravel.

Where this soil grades to the Darroch and Foresman soils, the surface layer is darker and the organic content is higher than normal. The depth to mottling varies from 7 to about 15 inches, and in thickness and sequence the various layers below a depth of about 30 inches are extremely variable. A few areas are underlain by glacial till below a depth of 30 inches.

Use and management.—Kibbie silt loam occurs in close association with Crosby silt loam and Tuscola soils and grades to the group of soils developed on similar parent material under a prairie vegetation. A field may and often does include several soils besides this one. Crop rotations and management practices are adjusted somewhat, depending upon the proportion of the various soils in a field. The crops grown are corn, soybeans, wheat, oats, and hay. Additions of organic matter, commercial fertilizers, and lime, together with the use of a rotation system that includes clover and alfalfa, will help maintain and increase productivity.

Maumee fine sandy loam (MA).—This soil has developed on calcareous loose sand of the glaciofluvial outwash plains and lake plains. It is the very poorly drained very dark member of the soil catena that also includes the dark very poorly drained Granby soils. It is associated with Granby, Newton, Dillon, and Morocco soils, principally in the Kankakee Lake Plain area. Surface relief ranges from 0 to 2 percent on the nearly level areas or broad depressional flats. Surface runoff is very low, and most areas were ponded under natural drainage conditions. The greater part of the soil has artificial drainage sufficient to permit cropping, but considerable acreage still needs more adequate drainage. The areas needing better drainage are designated on the soil map by marsh symbol. After the water table has been lowered, the movement of water through the soil is rapid to very rapid. The native vegetation was chiefly marsh grasses, but there was encroachment of water-tolerant trees in some areas.

Profile in a cultivated area:

0 to 8 inches, very dark-gray to nearly black loose fine sandy loam; organic content is high, somewhat higher than in the surface soil of Granby fine sandy loam; neutral to slightly acid.
8 to 22 inches, dark-gray to very dark-gray loose fine sandy loam; organic content somewhat lower than in the layer above; slightly acid to neutral.
22 to 34 inches, light-gray loamy fine sand to fine sand with a few yellow and brown mottlings in the lower part; upper 2 or 3 inches shows some penetration of the dark material from layer above; neutral.
34 to 50 inches, mottled light-gray and yellow loose fine sand to sand; neutral to mildly alkaline.
50 inches +, mottled gray and yellow loose calcareous fine sand.

The total thickness of the dark surface and upper subsoil layers varies from 16 to 28 inches. The organic content of the surface soil is somewhat variable and increases where this soil grades to Houghton

loamy muck over sand. There is in places a gradual gradation from this soil to Granby fine sandy loam and an accompanying decrease in organic content and in the thickness of the dark surface and subsurface layers. Where this soil grades to the Dillon soils, there is in many places a gradual gradation from neutral to very strongly acid. The boundaries between this soil and the Dillon are somewhat arbitrarily drawn.

Use and management.—Maumee fine sandy loam is relatively high in content of organic matter and nitrogen, but its supply of phosphate and potash is usually relatively low. The crops grown are corn, soybeans, oats, wheat, and some hay. Yields are medium to high. A commercial fertilizer high in phosphate and potash probably should be used with most crops. Additions of lime are necessary for clover and alfalfa only in those areas transitional to the Dillon soils. On the areas of transition the acidity is slightly higher than normal.

Good to excellent stands of bluegrass pasture are maintained on this soil, and the areas having drainage inadequate for crop production are in permanent pasture. The quality and livestock carrying capacity of the pasture areas somewhat depend upon the degree of drainage, or the time water remains at the surface.

A few areas in the northwestern part of Lincoln Township and in the northeastern part of Lake Township have an upper subsoil with a heavier texture than normal. The productivity of these areas is somewhat higher than normal for the type. This heavier soil is well suited to such vegetables as asparagus and celery.

Maumee fine sandy loam, mucky subsoil phase (Mc).—A higher content of organic matter in the surface soil, a layer of colloidal mucky material in the upper subsoil, and the mildly alkaline to calcareous nature of the surface and upper subsoil distinguish this soil from Maumee fine sandy loam. It occurs chiefly in one relatively large area and is associated with the mucky subsoil phase of Granby fine sandy loam. The slopes range from 0 to 2 percent. Natural drainage, surface runoff, and permeability are comparable to those for Maumee fine sandy loam.

Profile in a cultivated area:

0 to 8 inches, very dark-gray loose fine sandy loam; high organic content; mildly alkaline.
8 to 20 inches, very dark-gray to very dark brownish-gray colloidal mucky firm and feltlike material; breaks into thin platy pieces ¼ to ½ inch thick and 3 or more inches long; mildly alkaline.
20 to 30 inches, light-gray loose loamy fine sand to fine sand; mildly alkaline to calcareous.
30 to 70 inches +, mottled gray and pale-yellow loose fine sand; calcareous.

Use and management.—The principal crops grown on Maumee fine sandy loam, mucky subsoil phase, are corn, oats, soybeans, and wheat. An occasional crop of clover or mixed hay is also grown. The organic and nitrogen content is high, but the soil is low in phosphate and potash. Liberal applications of commercial fertilizer of an 0–8–24 or 0–20–20 analysis should be used with crops. Recently there has been some tendency toward use of small quantities of nitrogen in the fertilizer. Some farmers are using 250 pounds or more an acre of fertilizer with a 3–12–12 analysis. When properly fertilized and managed, crops yield higher than on Maumee fine sandy loam.

968833—55——5

There is some loss from lodging of small grains, particularly of oats, but use of the new stiffer strawed varieties will reduce the loss considerably.

Maumee fine sandy loam, ferruginous phase (Mb).—Characterizing this phase are yellow iron stains and small yellow segregations, or concretions, of bog iron on the surface and through the surface soil and upper subsoil. The quantity of iron, though variable, is sufficient to give the soil a decided yellow color. The soil occurs in close association with Maumee fine sandy loam, and in some places the boundaries between the two are arbitrarily drawn.

Use and management.—Because Maumee fine sandy loam, ferruginous phase, is closely associated with Maumee fine sandy loam, the crop rotations and management practices used are essentially the same. Yields are also about the same. Some areas of this soil have a slightly better moisture-holding capacity than Maumee fine sandy loam.

Maumee loam (Md).—This soil has developed on loose calcareous sand of the glaciofluvial outwash and lake plains. The range in slope is 0 to 2 percent. Surface runoff is very low, and most of the soil was under water a considerable part of each year when natural drainage conditions prevailed. Practically all areas are now drained well enough to permit cropping. Where outlets are available, drainage is easily accomplished by lowering the general water table of the area. The movement of ground water through the loose sandy material is rather rapid. The native vegetation was chiefly marsh grasses.

The surface 6 to 8 inches in cultivated areas is very dark-gray friable loam relatively high in organic content and slightly acid to neutral in reaction. Underlying this layer and continuing downward to a depth of about 20 inches is very dark-gray to dark-gray loam. The profile below a depth of 20 inches is much like that of Maumee fine sandy loam.

Use and management.—Maumee loam occurs in close association with other Maumee soils, and the crops grown are similar to those produced on Maumee fine sandy loam. In moisture-holding capacity this soil is considerably better than the lighter-textured ones, and crop yields are therefore higher than those obtained on Maumee fine sandy loam. The organic and nitrogen contents of the surface and upper subsoil layers are relatively high, but the supply of potash and phosphorus is deficient in both layers.

Liberal applications of fertilizer high in potash and phosphorus, as for example those with analyses of 0–8–24 or 0–20–20, are necessary for higher crop yields. Some loss of small grains, particularly of oats, results from lodging, which is caused by the high organic content of the surface soil. The stiffer strawed varieties of oats will help to reduce this loss. A few areas not drained well enough for crop production are in permanent bluegrass pasture or support a mixed growth of bluegrass and native herbs and grasses. The livestock carrying capacity of most areas in permanent bluegrass pasture is high.

Maumee loamy fine sand (Me).—This very dark, very poorly drained soil has developed on loose calcareous sand. It occurs in association with Maumee loam and fine sandy loam on slopes of 0 to 2 percent. In places there is a gradual transition in surface texture

from loamy fine sand to fine sandy loam, and boundaries between this soil and Maumee fine sandy loam therefore may be arbitrarily drawn. The profile characteristics are comparable with those of Maumee fine sandy loam, except that the surface and upper subsoil layers have a loamy fine sand texture. When the surface soil is dry, the light-gray quartz sand grains stand out in contrast to the dark-gray organic material. Wind erosion is somewhat of a problem where clean cultivation is practiced, and several areas show the effects of such erosion. The shifting sands do some damage to small plants.

Use and management.—Corn and soybeans are the principal crops grown on Maumee loamy fine sand, especially in field made up largely or wholly of this soil. Lesser acreages of wheat, oats, and hay crops are grown. Some areas are somewhat droughty because the water table has been lowered to obtain drainage for adjacent areas of muck.

Miami silt loam, undulating phase (MK).—This soil has developed on highly calcareous light- to medium-textured glacial till of Late Wisconsin age. It is the well-drained member of the soil catena that also includes the imperfectly drained Crosby, poorly drained Bethel, very poorly drained dark Brookston, and very poorly drained very dark Clyde soils. In this county, however, the Bethel and Brookston soils do not occur in sufficient extent to be shown separately on the map. Relief ranges from 2 to 5 percent. Surface runoff is medium and internal drainage is moderate. The native vegetation was principally oak, maple, elm, and hickory.

Profile in a cultivated area:

0 to 8 inches, grayish-brown friable silt loam of medium crumb structure; relatively low organic content; slightly to medium acid.

8 to 12 inches, light yellowish-brown friable heavy silt loam; coarse crumb structure in the upper part gradually changes with depth to fine nuciform in the lower part; medium acid.

12 to 30 inches, yellowish-brown to brownish-yellow silty clay loam; breaks into fine nuciform aggregates in the upper part but there is a gradual change to coarse or very coarse nuciform aggregates below; partly weathered rock fragments are contained in variable quantities; layer is medium acid in the upper part and with a gradual change becomes slightly acid or neutral in the lower 2 or 3 inches.

30 inches +, yellowish-brown or brownish-yellow clay loam highly calcareous glacial till composed of unassorted silt, clay, sand, and rock fragments.

In a few small included areas the surface texture is loam to heavy loam. Where this soil grades to the Parr soils, the surface soil is darker and the organic content is somewhat higher than normal. The depth to calcareous till ranges from about 25 to 40 inches. Where this soil grades to Tuscola soils, the lower subsoil may consist of stratified layers of silt, fine sand, and clay.

Use and management.—The crop rotation in general use on Miami silt loam, undulating phase, is corn, oats or wheat, soybeans, and hay. The hay is chiefly a mixture of clover, alfalfa, and timothy. The organic and nitrogen content of the surface soil is relatively low, and it is necessary to apply all available barnyard and green manure to maintain productivity. The soil is probably somewhat better suited to wheat than to oats, but good yields of either crop, or of all the crops mentioned, can be obtained under good management. Additions of lime are usually necessary for the successful growth of clover and alfalfa. The rotations should include a somewhat higher proportion of small grains and hay crops than is used on Parr soils.

A few small areas are in permanent bluegrass pasture. The carrying capacity of the pastures is high, especially after the addition of lime and liberal quantities of phosphate fertilizer. A few small areas are in timber.

Miami silt loam, eroded undulating phase (MG).—From the undulating phase of Miami silt loam this soil differs in having lost 50 percent or more of the surface soil through erosion. Included are a few patches where practically all of the surface soil and a part of the subsoil have been removed. The present surface 6 to 8 inches, consisting in part of material that was formerly subsoil, is yellowish-brown to brownish-yellow heavy silt loam to light clay loam very low in organic content and poor in tilth. The rest of the profile is comparable with the corresponding part of the undulating phase. The soil occurs on slopes of 2 to 5 percent in association with the other phases of Miami silt loam.

Use and management.—Miami silt loam, eroded undulating phase, is practically all cultivated, chiefly to corn, soybeans, wheat, oats, and hay. Crop yields are considerably lower than those obtained on the undulating phase. The content of organic matter and nitrogen is very low, and it is essential that large quantities of organic matter be turned under and that the rotations be composed largely of small grains and hay. The proportion of clean-cultivated crops in the rotation should be small. Bluegrass pasture is of fair to medium quality, but most areas in pasture need to be limed and treated with liberal quantities of phosphate fertilizer to increase the livestock carrying capacity.

Miami silt loam, eroded sloping phase (MF).—This soil occurs in long narrow strips adjacent to drainageways on slopes of 5 to about 8 percent. Erosion has removed 50 percent or more of the surface soil and in some places a part of the subsoil. The profile characteristics for a large part of the soil are comparable with those of the eroded undulating phase. The degree of erosion is not uniform over the areas, and the lighter colored and heavier textured subsoil is exposed here and there. The present 6- to 8-inch surface layer is a yellowish-brown to brownish-yellow heavy silt loam to clay loam low in organic content. Tilth conditions are poor.

Included with this phase are small only slightly eroded areas occurring on similar slopes. In profile characteristics the included areas are essentially the same as the undulating phase of Miami silt loam, but the layers are somewhat thinner and the depth to calcareous till is slightly less.

Use and management.—A considerable part of Miami silt loam, eroded sloping phase, is farmed with the undulating and eroded undulating phases; rotations are therefore similar. Yields, however, are lower than those obtained on the undulating phase. Moisture relations are also less favorable for crop growth, and erosion is more of a hazard than on the undulating areas. Some of this soil is in permanent bluegrass pasture; most of the pastures need lime and fertilizer, and some should be reseeded. The included areas showing only a slight degree of erosion are largely in timber.

Miami silt loam, moderately steep phase (MH).—Slopes of this phase range from 12 to 20 percent or more. The profile characteris-

tics are similar to those of the undulating phase, except that the various layers are thinner and the depth to calcareous till is considerably less. Surface runoff is high and internal drainage is moderate.

Included with this soil are small areas where 50 percent or more of the surface soil, and in some places a part of the subsoil, has been removed by erosion. In these areas the surface material ranges from grayish brown to brownish yellow and is very low in organic content.

Use and management.—Miami silt loam, moderately steep phase, is very susceptible to erosion under cultivation, especially where it is used for such crops as corn and soybeans. It is probably better suited to bluegrass pasture or forest than to cultivated crops. Alfalfa would probably produce good crops, especially on the milder slopes and after liming and fertilizing. Some areas of permanent bluegrass pasture need reseeding and the addition of relatively large quantities of commercial fertilizer high in phosphate.

Morocco fine sandy loam (Ml).—This soil has developed on loose acid sand of the glaciofluvial outwash and lake plains. It is the imperfectly drained member of the soil catena that also includes the excessively drained Plainfield, moderately well drained Berrien, very poorly drained dark Newton, and very poorly drained very dark Dillon soils. It occurs chiefly in the southern part of the Kankakee Lake Plain area in association with the soils of its catena. In many places it is only a few feet above the adjacent dark soils. Slopes range between 0 and 2 percent.

Surface runoff is very low, and in most areas artificial drainage is necessary for crop production. Where outlets are available, drainage is easily accomplished by lowering the general water table of the area. In draining adjacent lower lying areas of dark soils and mucks, the water table has been lowered in this soil to such an extent that many areas are droughty. The native vegetation was principally pin oak with some black and white oaks.

The surface 7 to 8 inches in cultivated areas is light brownish-gray loose fine sandy loam low in organic content. This layer is underlain by mottled gray and yellow loose fine sandy loam that grades rather quickly to fine sand or sand. The profile is strongly to very strongly acid to a depth of 70 inches or more.

Use and management.—Morocco fine sandy loam is somewhat more productive than Morocco loamy fine sand, and crop yields are slightly higher. The principal crops are corn, oats, and soybeans, but wheat and hay are occasionally grown. The soil is very low in organic content and plant nutrients, and liberal applications of these materials are necessary to maintain and increase production. It is somewhat droughty for oats and is not well suited to corn and soybeans. A few areas are in permanent bluegrass pasture, and some are in forest.

Morocco loamy fine sand (Mm).—This soil has developed on loose acid sand of the glaciofluvial outwash and lake plains. It is the imperfectly drained member of the soil catena that also includes the excessively drained Plainfield, moderately well drained Berrien, very poorly drained dark Newton, and very poorly drained very dark Dillon soils. It occurs in close association with those soils, and in places its position is intermediate between the Berrien and the dark Newton and Dillon soils.

The soil has nearly level relief; slopes range between 0 and 2 percent. Surface runoff is very low, and internal drainage is slow in the presence of a high water table. Artificial drainage is necessary for crop production. Although most areas have been successfully drained to permit cultivation, a few still need more adequate drains. Where outlets are available, drainage is easily accomplished by lowering the general water table of the area. After the water table has been lowered, moisture moves rapidly through the soil. The native vegetation was chiefly pin oak with some black and white oaks.

Profile in a cultivated area:

0 to 8 inches, light brownish-gray loose loamy fine sand; low organic content; strongly to very strongly acid.
8 to 70 inches +, mottled gray and yellow loose loamy fine sand that gradually changes to fine sand or sand as depth increases; a thin lens or layer of feebly coherent material occasionally occurs below a depth of 30 inches.

The depth to mottling varies from 6 to about 14 inches; the greater depth to mottling occurs where this soil grades to the Berrien. In undisturbed wooded areas the surface 2 or 3 inches is dark gray and contains considerable organic matter.

Use and management.—About 20 percent of Morocco loamy fine sand is under cultivation. Corn, oats, and soybeans are the chief crops. The soil is low in organic content and plant nutrients, and yields of most crops are low. This soil is droughty in summer and early in fall for most crops. It is especially droughty in those areas where the general water table has been lowered to drain adjacent areas of dark soils or mucks. In such areas moisture is the limiting factor in crop growth.

The soil responds well to applications of organic matter and commercial fertilizer, but because the profile is loose and porous, these materials are leached quickly. Areas not under cultivation are in forest, woodland pasture, or are idle. The pasture is usually of only fair quality and could be improved considerably by adding lime and commercial fertilizer. Moderate to severe wind erosion occurs in a few small areas, and in these a few small blow-outs are present. In the wind-eroded areas part of the surface soil and in some places part of the subsoil have been blown onto adjacent areas of dark soils.

Newton fine sandy loam (Na).—This soil occupies glacial outwash and lake plains and has developed on loose acid sand. It is the very poorly drained dark member of the soil catena that also includes the excessively drained Plainfield, moderately well drained Berrien, imperfectly drained Morocco, and very poorly drained very dark Dillon soils. It occurs on nearly level or depressed areas (0 to 2 percent slopes), often on extensive depressed flats. Surface runoff is very low, and much of the soil was ponded a part of each year when naturally drained. Internal drainage is very slow under natural conditions but rapid after the general water table of the area has been lowered by artificial drainage. Permeability is rapid. This soil is comparable with Granby fine sandy loam in natural drainage and color but differs in being strongly acid instead of slightly acid to neutral. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray, very friable fine sandy loam; relatively high organic content; strongly to very strongly acid.

8 to 14 inches, very dark-gray to dark-gray fine sandy loam; organic content is relatively high in the upper part but decreases slightly with depth; a few faint yellow mottlings show in the lower 2 or 3 inches; strongly to very strongly acid.

14 to 90 inches +, mottled yellow and gray loose sandy loam to sand; mottling increases in intensity with depth; strongly to very strongly acid to a depth of 75 inches or more and in most areas there is then a gradual change to medium or slightly acid.

The thickness of the dark surface and subsurface layers varies from 10 to 16 inches, and the organic content is also somewhat variable. Where this soil grades to Dillon fine sandy loam, the thickness of the dark layers is greater than normal and the subsoil is predominantly gray to a depth of 24 inches. Where it grades to Morocco soils, the organic content of the surface soil is less than normal and the thickness of the dark layers is also somewhat less than in the profile described. The boundaries between this soil and the Granby and Maumee are in many places arbitrarily drawn. In such areas of transition there is a gradual change from the strongly to very strongly acid Newton soil to the slightly acid Maumee and Granby.

Use and management.—Newton fine sandy loam is used mainly for corn, soybeans, and oats, occasionally for clover, and sometimes for wheat and timothy. Drainage is the first requisite for cropping. Most areas have sufficient artificial drainage but a few should be better drained. Where outlets are available, drainage is easily accomplished by lowering the general water table of the area.

Crop yields are low, even under the best management practices. The organic content is relatively high, but the content of available phosphate and potash is apparently low. The soil is probably better suited to wheat than to oats, and it is usually too strongly acid for the successful growing of alfalfa. After sufficient lime has been added, fair to good stands of bluegrass can be maintained.

Newton loamy fine sand (Nb).—This soil has developed on loose acid sand of the glacial outwash and lake plains. It is the very poorly drained dark member of the soil catena that also includes the excessively drained Plainfield, moderately well drained Berrien, imperfectly drained Morocco, and very poorly drained very dark Dillon soils. It occurs in slight depressions or on broad depressed flats, principally in the Kankakee lacustrine section. The slope range is 0 to 2 percent. Surface runoff is very low, and most of the areas were ponded a part of each year under natural drainage conditions. The greater part of the land now has artificial drainage sufficient to permit cultivation, but some areas need more adequate drainage. Internal drainage is very slow under natural conditions, but after the water table has been lowered, water moves fairly rapidly through the profile. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray to dark-gray loose loamy fine sand; relatively high organic content; when dry, the light-gray quartz sand grains stand out in contrast to the dark organic matter; strongly to very strongly acid.

8 to 12 inches, dark-gray loose loamy fine sand; organic content somewhat lower than in the layer above; slight yellow mottlings occur in the lower inch or two; strongly to very strongly acid.

12 to 75 inches +, mottled yellow and gray loose fine sand to sand; mottling increases in intensity to a depth of about 30 or 40 inches; material below a depth of 40 inches is in many places predominantly gray; layer

is strongly to very strongly acid to a depth of 60 to 75 inches and below that depth changes very gradually to medium or slightly acid.

In organic content and thickness the surface and subsurface layers are variable from place to place. The total thickness of the two layers varies from 8 to 15 inches, the greater depth usually occurring where this soil grades to the Dillon. Where this soil grades to the Granby and Maumee, there is in places a gradual change from very strongly acid to medium or slightly acid. The boundaries between this soil and those it grades to are in some instances arbitrarily drawn. Where this soil grades to the Morocco, the thickness of the dark layers and the organic content are less than normal.

Use and management.—The chief crops grown on Newton loamy fine sand are corn, soybeans, and oats; smaller quantities of wheat and hay are produced. Crop yields are low. For alfalfa, large quantities of lime need to be added to reduce acidity. The soil is somewhat droughty in summer and in fall, especially in places where the water table has been lowered considerably over a general area. Some of the land is in permanent bluegrass pasture of fair quality. The pasture probably could be improved by the use of lime and by additions of commercial fertilizer high in phosphate and potash.

Odell loam (OA).—Highly calcareous light-textured glacial till of Late Wisconsin age is the material on which this soil developed. It is the imperfectly drained member of the soil catena that also includes the well-drained Parr, moderately well drained Corwin, very poorly drained Chalmers, and very poorly drained dark Clyde soils. With these soils it forms an intricate pattern. It occurs on nearly level relief on slopes of 0 to 2 percent. In many places the areas are irregularly shaped. Surface runoff is low and internal drainage is slow. Artificial drainage, usually necessary for successful crop production, can be accomplished by using either tile lines or open ditches. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to very dark brownish-gray friable granular loam; relatively high organic content; slightly to medium acid.

7 to 14 inches, dark-gray to very dark brownish-gray friable heavy loam to light silt loam of coarse granular to fine platy structure; organic content is high in the upper part and diminishes with depth; lower inch or two shows slight pale-yellow coloration; medium acid.

14 to 17 inches, mottled gray, yellow, and brown light clay loam; breaks into fine nuciform aggregates that are friable when moist and only slightly hard when dry; medium acid.

17 to 32 inches, mottled gray, yellow, and brown clay loam; breaks into coarse to very coarse nuciform aggregates, slightly plastic when moist and hard when dry; medium acid in upper part and grades to slightly acid or neutral below.

32 inches +, mottled gray and yellow highly calcareous loam to light clay loam glacial till composed of unassorted silt, sand, clay, and rock fragments.

In content of organic matter and in total thickness the surface and upper subsoil layers are variable. The thickness varies from 10 to about 16 inches; the depth to mottling, from 10 to 15 inches; and the depth to calcareous till, from 28 to 45 inches. Where this soil grades to the Corwin, the depth to mottling is slightly greater than normal; where it grades to Chalmers, the color is darker and the organic content higher than normal. Areas of this soil on the Marseilles moraine and the Iroquois lacustrine sections contain small patches where

the material below a depth of about 30 inches is stratified silt and fine sand with which some clay is mixed. In respect to the material in these areas, this soil resembles Darroch loam.

Use and management.—Crop rotations and management practices used on Odell loam are similar to those on Odell silt loam. Corn, soybeans, oats, wheat, and hay are grown; the corn, soybeans, and oats predominate. The soil is well suited to these crops, and high yields are obtained under present management practices. Over a period of years, however, the higher yields are obtained where clover or alfalfa are grown in the rotation, or where sweetclover is used as an intercrop and plowed under as green manure. Liming is usually necessary for the more successful growth of clover or alfalfa, but both crops are well suited if adequate artificial drainage has been installed. There is some injury to clover and alfalfa from heaving.

Odell silt loam (Ob).—This soil has developed under a tall prairie grass vegetation on highly calcareous light- to medium-textured glacial till of Late Wisconsin age. It is the imperfectly drained member of the soil catena that also includes the well-drained Parr, moderately well drained Corwin, very poorly drained Chalmers, and very poorly drained very dark Clyde soils. Relief is nearly level; the slope range is 0 to 2 percent. Surface runoff is low and internal drainage is slow. Susceptibility to erosion under cultivation is low.

Profile in a cultivated area:

0 to 7 inches, very dark-gray to very dark brownish-gray friable silt loam; relatively high organic content; slightly to medium acid.

7 to 12 inches, dark-gray to very dark-gray friable silt loam to heavy silt loam; organic content is high in the upper part and diminishes with depth; breaks into coarse granular or fine nuciform aggregates; medium acid.

12 to 17 inches, mottled gray and pale-yellow silty clay loam; breaks into fine nuciform aggregates; slightly plastic when moist and slightly hard when dry; medium acid.

17 to 32 inches, mottled gray, yellow, and brown silty clay loam to heavy silty clay loam; breaks into coarse to very coarse nuciform aggregates; slightly plastic when moist and hard when dry; contains variable quantities of partly weathered stones; medium acid above and gradually becomes slightly acid or neutral below.

32 inches +, mottled light-gray and light-yellow highly calcareous clay loam glacial till composed of unassorted silt, clay, sand, and rock fragments.

The surface and subsurface layers are relatively high in organic matter and have a combined thickness of 10 to 16 inches. The depth to calcareous till ranges from 28 to 42 inches. Where this soil grades to the Corwin, the depth to mottling is somewhat greater than normal and and the organic content of the surface soil is a little lower. Where it grades to Chalmers soils, the thickness of the dark surface and subsurface layers is greater, the organic content is higher, and the surface soil and subsoil are less acid than normal. Included with this soil are small areas having a subsoil somewhat heavier textured than normal.

Use and management.—Odell silt loam occurs in relatively large and in small irregularly shaped areas closely associated with the Chalmers, Corwin, Parr, and, in some instances, the Foresman and Darroch. A field seldom consists largely or wholly of this soil, and rotations and management practices are therefore governed somewhat by the extent of the associated soils. The crops grown are corn, soybeans, wheat, oats, and hay. Rotations are somewhat variable but are made up

predominantly of corn, oats, and soybeans. A rotation in use on some areas is 1 year of corn and 1 year of oats with an intercrop of sweetclover. The oats are harvested, the sweetclover is turned under the following spring, and the rotation is then repeated. A rotation of corn, soybeans, and oats is also used on a considerable acreage. Where this soil forms a small part of a field made up largely of Chalmers soils, corn may be planted for two or more consecutive years.

Artificial drainage is necessary for successful cropping. Most areas have been drained, but a few need more adequate drainage. Liming is usually necessary for the successful growth of clover or alfalfa. The common practice is to use commercial fertilizer with corn and small grains, but commercial fertilizer is usually not applied directly to soybeans. Instead, the preceding crop is fertilized heavily, and the soybeans benefit from the residual effect of that application. Excellent stands of bluegrass are obtained, and the livestock carrying capacity is high. Some of the pastures, however, could be materially improved by the use of sufficient lime and commercial fertilizer.

Parr fine sandy loam, undulating phase (PA).—This soil has developed on highly calcareous light-textured glacial till of Late Wisconsin age. It is the well-drained member of the soil catena that also includes the moderately well drained Corwin, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark Clyde soils. It is on slopes of 2 to 5 percent and occurs mainly in the Marseilles moraine section. It is closely associated with the phases of Parr loam and with the Ayr and Ade soils. Because the morainic material is not uniform, the line of separation between this soil and the associated soils is in many instances arbitrary. Surface runoff is medium and internal drainage is moderate. Erodibility under cultivation is moderate to high. The native vegetation was tall prairie grasses.

Use and management.—The rotations used on Parr fine sandy loam, undulating phase, are similar to those for the Parr loam soils. They include corn, oats or wheat, soybeans, and hay crops. This soil is not so well suited to any of these crops as the heavier textured Parr soils, and crops are occasionally injured by a lack of moisture in summer and early in fall. The soil is better suited to alfalfa than to other hay crops.

Liming and the liberal use of commercial fertilizer are necessary to maintain and improve crop yields. The addition of barnyard manure and the turning under of green-manure crops are necessary to maintain the organic and nitrogen supply. Some areas are in permanent bluegrass pasture. These pastures could be improved by using lime and a commercial fertilizer high in phosphate and potash and by controlling weeds.

Parr loam, undulating phase (PE).—This soil has developed on highly calcareous light- to medium-textured glacial till. It is the well-drained member of the soil catena that also includes the moderately well drained Corwin, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark Clyde soils. It occurs on upland areas and has relief ranging from 2 to 5 percent. Surface runoff is medium and internal drainage is moderate. The soil is moderately susceptible to erosion under clean cultivation. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to very dark grayish-brown friable loam having fine to medium granular structure; relatively high organic content; medium acid.
7 to 15 inches, dark grayish-brown heavy loam of coarse granular to fine nuciform structure; organic content relatively high in upper part but diminishes with depth; medium acid.
15 to 20 inches, yellowish-brown to brown friable silt loam of fine to medium nuciform structure; upper 2 or 3 inches shows some penetration of organic matter from the layer above; medium acid.
20 to 35 inches, yellowish-brown to brown silty clay loam of coarse to very coarse nuciform structure; slightly plastic when moist and hard when dry; medium acid above but grades to slightly acid below.
35 inches +, pale-yellow or yellowish-brown highly calcareous loam to light clay loam glacial till consisting of unassorted silt, sand, clay, and rock fragments.

The soil varies chiefly in the thickness and organic content of the surface and subsurface layers, in texture of the subsoil, and in depth to calcareous till. The thickness of the first two layers varies from 10 to 18 inches, and the depth to calcareous till ranges from 28 to 45 inches. Where this soil grades to Corwin loam, the subsoil below a depth of about 30 inches may be slightly mottled with gray and yellow. Included are a few areas that have fine sandy loam surface soil and sandy loam to light sandy clay loam subsoil and are underlain by loam glacial till. The included areas occur on the Marseilles moraine and form an intricate and complex pattern with areas of this soil. Also included are areas of Ayr, Ade, and Jasper soils too small to be delineated on the map. Considering these inclusions, many areas of this soil are in reality a complex.

Use and management.—The crop rotation in general use on Parr loam, undulating phase, is made up of corn, oats, soybeans, and hay. A rotation used on some areas is 1 year of corn and 1 year of oats with an intercrop of sweetclover. The sweetclover is turned under the spring following the harvesting of the oats and the land is planted again to corn. Oats are more commonly grown than wheat, although the soil is suited to both crops. Both oats and wheat are fertilized. Soybeans are suited and are usually fertilized indirectly by applying large quantities of fertilizer to the preceding crop.

Most areas need liming for the successful growth of clover or alfalfa, and better stands of these crops are obtained after the use of lime and commercial fertilizer. Although the organic content of the surface layer is relatively high, increased yields can be obtained by using a rotation system that includes hay crops and by turning under green-manure crops. Some farmers have used nitrogen fertilizer and obtained increased yields. The soil is well suited to bluegrass pasture, but many of the pastures could be improved by liming, fertilizing, and weed control. Some of the areas occur on long mild slopes, and on these erosion may be a problem in management that rotations should be adjusted to meet. Probably strip cropping or contouring is feasible for such areas.

Parr loam, eroded undulating phase (Pc).—This soil differs from the undulating phase in having lost 25 to 75 percent of its surface soil through erosion. The present surface soil in many places consists partly of material that was formerly subsoil. The organic content is generally lower than in the undulating phase, and tilth conditions

are poorer. The uneroded part of the profile is comparable with that of the undulating phase.

Use and management.—Parr loam, eroded undulating phase, occurs in close association with other phases of Parr loam and with Corwin and Odell loams. The rotations and management practices used are essentially the same as those for the undulating phase of Parr loam, but crop yields are considerably lower. Where practicable the rotation should be lengthened and should include less clean-cultivated crops and more small grains and hay. To maintain and improve productivity, all available organic matter should be plowed under, and sufficient lime and commercial fertilizer should be used in the rotation. Many of the areas on long gentle slopes, present an erosion problem. Management practices should be adjusted for these eroded slopes, and strip cropping or contouring may be necessary.

Parr loam, severely eroded undulating phase (PD).—This soil occurs on slopes of 2 to 5 percent, and from 75 percent to all of the surface soil and a part of the subsoil have been removed by erosion. The present surface soil is yellowish-brown to brown heavy loam to silt loam and is low in organic content.

Use and management.—Tilth conditions of Parr loam, severely eroded undulating phase, are somewhat unfavorable for crop growth. With the removal of the surface soil, large quantities of organic matter, nitrogen, and other plant nutrients have been lost. Thus, crop yields are materially lower than those obtained on the undulating phase.

To prevent further loss from erosion and maintain and increase productivity, a longer rotation should be used. This rotation should consist largely of hay and small grains and should include corn and soybeans only a small part of the time. The soil should be limed where necessary, liberal quantities of commercial fertilizer should be used in the rotation, and all available organic matter should be turned under. Where this soil occurs on long gentle slopes, erosion control practices, as contouring and strip cropping, should be practiced. A few areas are in permanent bluegrass pasture of fair quality. These pastures could be improved by the use of lime and commercial fertilizer and by controlling weeds.

Parr loam, eroded sloping phase (PB).—A considerable part of the former surface soil has been removed from this phase by erosion. The present surface soil consists in part of material that was formerly subsoil. The organic content is considerably lower and the surface layer is thinner than for the undulating phase. The rest of the profile is comparable with that of the undulating phase, except the various layers are somewhat thinner. Slopes range from 5 to 8 percent. Included are a few small areas where only slight erosion has occurred. Here the profile, including the surface soil, is similar to that of the undulating phase.

Use and management.—A considerable part of Parr loam, eroded sloping phase, is cropped in about the same way as the other phases of Parr loam, although it is not so well suited to corn, soybeans, and such clean-cultivated crops. Erosion is potentially severe because of slope, and where practical the rotation should be altered to include hay crops more of the time. After sufficient lime and commercial fertilizer are applied, this soil should produce good stands of alfalfa.

It is probably better suited to alfalfa and permanent bluegrass pasture than it is to clean-cultivated crops, especially on the more severely eroded areas. In areas where erosion is less severe or only slight, a long rotation system and erosion control practices, as strip cropping and contouring, would probably stabilize erosion and maintain crop production. Erosion will be rapid under clean-cultivated crops such as corn and soybeans.

Parr silt loam, undulating phase (Pk).—This soil has developed on highly calcareous light- to- medium-textured glacial till of Late Wisconsin age. It is the well-drained member of the soil catena that also includes the moderately well drained Corwin, imperfectly drained Odell, very poorly drained Chalmers, and very poorly drained very dark Clyde soils. It occurs on uplands, principally on the Tipton Till Plain in the southern part of the county, on a relief of 2 to 5 percent. Surface runoff is medium and internal drainage is moderate. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown friable silt loam relatively high in organic content; small to medium granular structure; medium acid.
7 to 14 inches, dark grayish-brown to dark-brown friable medium to coarse granular silt loam; organic content is relatively high above but decreases with depth; material contains a few partly weathered stones; medium acid.
14 to 32 inches, yellowish-brown to brownish-yellow silty clay loam; fine nuciform structure above but coarse to very coarse nuciform structure below; layer contains occasional partly weathered stone and considerable gritty material; medium acid.
32 inches +, pale-yellow or brownish-yellow highly calcareous light clay loam to loam glacial till composed of unassorted silt, sand, clay, and rock fragments.

The quantity of rocks and boulders on the surface is variable and in places is sufficient to interfere with cultivation. Most of the stones and boulders have been removed, however. The thickness of the dark surface and subsurface layers varies from 9 to 16 inches. The depth to calcareous till varies from 25 to 45 inches. Where this soil grades to Corwin silt loam, the subsoil below a depth of 30 inches is slightly mottled with gray and brown. The subsoil and underlying till in a few areas are sandier than normal.

Use and management.—The rotation in general use on Parr silt loam, undulating phase, consists of corn, wheat or oats, soybeans, and hay. Corn usually follows hay crops in the rotation but may follow small grains or soybeans. A rotation in general use in some areas is corn, oats, and an intercrop of sweetclover. The sweetclover is seeded with the oats and turned under the following spring before the land is planted again to corn. This rotation helps to maintain the organic content and adds considerable nitrogen to the soil. Where the soil is not abused, good yields of corn have been maintained for a number of years under this rotation.

Oats usually follow corn in the rotation and to a considerable extent they are fertilized. Wheat is well suited, even though a much greater acreage is planted to oats than to wheat. It is common practice to fertilize wheat with 150 to 300 pounds an acre of fertilizer. Clover and alfalfa are both well suited, but additions of lime and commercial fertilizer are usually necessary to insure good stands. Bluegrass is well suited, and excellent stands with a high livestock

carrying capacity are maintained. Nonetheless, the carrying capacity of many areas could be increased by a more liberal use of lime and commercial fertilizer, especially of fertilizer high in phosphate and potash, and by carrying out a weed-control program.

Parr silt loam, eroded undulating phase (PH).—This phase occurs on slopes of 2 to 5 percent. A part or all of the surface soil and in a few areas a part of the subsoil have been removed by erosion. The present surface soil is yellowish-brown to dark-brown silt loam with an organic content variable but considerably lower than in the undulating phase. The present surface soil consists in part of material that was formerly subsoil, and tilth conditions are less favorable than on the undulating phase. The rest of the profile is comparable with that of the undulating phase, except the depth to calcareous till is generally somewhat less.

Use and management.—Because a part of the surface soil has been removed from Parr silt loam, eroded undulating phase, organic matter, nitrogen, and other plant foods have been lost. Consequently, the productivity is lower than for the undulating phase. The soil occurs in close association with the other phases of Parr silt loam. A field rarely consists largely or entirely of this phase, and therefore rotations and management practices are usually governed by the extent and character of the associated soils. The associated soils include the Corwin, Odell, and Chalmers.

Where practical, the rotation should be adjusted to include more hay crops and small grains and less clean-cultivated crops. The use of lime where necessary, the liberal use of commercial fertilizer, and the plowing under of all available organic matter will aid in maintaining and increasing productivity. These practices, together with the use of the rotation mentioned above, will also aid in checking erosion.

Parr silt loam, eroded sloping phase (PG).—A large part of the surface soil and in some places a part of the subsoil have been removed from this phase by erosion. The present surface soil consists, in part, of material that was formerly subsoil and varies from yellowish brown to dark brown. The rest of the profile is comparable with that of the undulating phase. Slopes range from 5 to 8 percent. Included with this soil are a few small areas only slightly eroded, and in surface color and organic content, these are very similar to the undulating phase.

Use and management.—Parr silt loam, eroded sloping phase, usually occurs in close association with the other phases of Parr silt loam and with Corwin and Odell soils, therefore rotations and management practices are usually about the same as on those associated soils. Crop yields, however, are considerably lower than on the undulating phase of Parr silt loam.

In the rotation the proportion of hay crops should be large and that of clean-cultivated crops should be small. Erosion control practices, as strip cropping and contouring, should be used where feasible. Some areas occur adjacent to drainageways, and a considerable part of these is in permanent pasture. The quality of the pastures could be bettered by liming, fertilizing, and weed control. Pasture is probably the best use for the areas near drainageways, although they

could be planted to alfalfa. After proper liming and fertilization, good stands of alfalfa can be obtained.

Parr silt loam, eroded moderately steep phase (Pr).—This phase occurs on slopes of 8 to 12 percent or more. A part or all of the surface soil and part of the subsoil have been removed over much of the area. The present surface soil consists in part of material that was formerly subsoil and is relatively low in organic content. Tilth conditions are less favorable for crop growth than on the undulating phase. Included are a few small areas only slightly eroded that have profile characteristics similar to those of the undulating phase, except the various layers are thinner and the depth to calcareous till is less.

Use and management.—Parr silt loam, eroded moderately steep phase, usually occurs as narrow elongated areas adjacent to drainageways and is now largely in bluegrass pasture. The quality of the pasture is fair to good but it could be materially improved by use of lime, fertilizer, and weed control. The soil is not well suited to clean-cultivated crops and is probably better suited to bluegrass pasture or alfalfa. Good stands of alfalfa can be obtained and maintained if sufficient lime and fertilizer is used and the seed is properly inoculated.

Plainfield fine sand, undulating phase (Po).—This soil has developed on loose acid sand. It has slopes of 0 to 5 percent, has been only slightly affected by wind erosion, and occurs in close association with the other phases of Plainfield fine sand on undulating or nearly level tops of dunelike ridges. Surface runoff is very low and internal drainage is very rapid. The soil is susceptible to wind erosion when it is without a protective cover of trees or close-growing crops. The native vegetation was predominantly black oak.

Profile in a cultivated area:

0 to 8 inches, light grayish-brown to yellowish-brown loose incoherent fine sand; very low organic content; strongly acid.
8 to 30 inches, light brownish-yellow loose incoherent fine sand; strongly acid.
30 to 80 inches +, light-yellow to light grayish-yellow loose fine sand to sand that contains an occasional lens or layer of slightly coherent usually light-yellow material; strongly acid to a depth of 6 feet or more, then a gradual change to medium or slightly acid.

In mineralogical content the soil is largely quartz; only a small percentage is of other minerals. In mineral content the soil differs somewhat from the Coloma. Included with this soil are small areas the same in all profile characteristics except reaction. These included areas are only slightly acid from the surface down, and because they are closely associated with the normal soil, it is probable that some of them were formerly sites of Indian camp grounds.

Use and management.—Plainfield fine sand, undulating phase, is low in organic matter and plant nutrients, and because of the loose nature of the entire profile, these materials are quickly leached. Water is the limiting factor in crop production, for the soil is not able to retain enough moisture to satisfy the requirements of most of the crops common to the area. Corn, oats, and soybeans are not well suited, and yields are usually low. Wheat and rye are better suited than oats. Fair stands of alfalfa are obtained after heavy applications of lime, but they are frequently damaged by wind erosion or by

shifting sands. A mixture of alfalfa and bromegrass is probably better suited than alfalfa alone. The soil is somewhat suited to small fruit crops, melons, and cucumbers. A few areas are cropped to melons, but very little small fruit is grown.

Some areas of this soil are in permanent pasture, but the quality is only fair to poor. Because of the looseness and droughtiness of the soil, good stands of bluegrass are difficult to maintain, especially when they are pastured by cattle. The bluegrass dies down early in summer, and cattle trampling the ground tend to destroy it. A considerable area is in timber, mostly black oak, but tree growth is slow.

Plainfield fine sand, wind-eroded undulating phase (Pr).—This soil occupies areas on slopes of 0 to 5 percent where wind erosion has removed a large part of the surface soil. The present surface soil consists in large part of material that was formerly subsoil. Very little organic matter remains, and in this condition the soil is subject to further wind erosion. An occasional small blow-out occurs where the wind has removed the surface and subsoil to a depth of 3 to 5 feet or more.

Use and management.—There is some attempt to cultivate small areas of Plainfield fine sand, wind-eroded undulating phase, but the greater part is now in poor quality pasture or idle and covered with briers, shrubs, weeds, and very little bluegrass. The soil is not suited to most field crops of the area. If organic matter were added and lime and fertilizer were applied, fair yields of rye and wheat probably could be obtained. A mixture of alfalfa and bromegrass is likely the best pasture, but these plants are often severely injured by sand blowing from this and adjacent areas.

Plainfield fine sand, severely wind-eroded undulating phase (Pn).—Slopes for this soil range from 0 to about 5 percent. Practically all of the surface soil and the subsoil to a considerable depth have been removed by wind erosion. Blow-outs (places where wind has removed the soil to a depth of 3 to 6 feet or more) are very numerous and in places make up a large part of the areas. The blow-out areas now have little economic value. The sparse vegetation consists mainly of briers, various weeds, and a few small shrubs. The sand removed from the blow-outs not only affects this soil but also does considerable damage to young plants on adjacent soils.

Plainfield fine sand, rolling phase (Pl).—Slopes for this phase range from 5 to 20 percent or more but are dominantly between 5 and 12 percent. Only slight wind erosion has occurred. The profile characteristics are comparable with those of the undulating phase. Areas of this soil occur as long dunes or ridges that are in many places crescent-shaped or that form a fringe around milder slopes of Plainfield fine sand or Berrien soils.

Use and management.—Practically all of Plainfield fine sand, rolling phase, is now in forest vegetation, chiefly black oak. The soil is not well suited to the common field crops but is somewhat suited to small tree fruits and melons. It is droughty, and the supply of organic matter and plant nutrients is low. Wind erosion is potentially severe under clean cultivation.

Plainfield fine sand, wind-eroded rolling phase (Pp).—This phase occurs on slopes of 5 to 20 percent or more, but the dominant

range is 5 to 12 percent. Wind erosion has removed a considerable part of the original surface soil, and the present surface soil consists in large part of material that was formerly subsoil. The organic content of the surface soil is extremely low. A few blow-outs occur, and in these the wind has removed the surface soil and subsoil to a depth of 3 to 5 feet or more.

Use and management.—Only a small part of Plainfield fine sand, wind-eroded rolling phase, is now under cultivation. The greater part is in low-grade pasture or is idle. The few areas under cultivation are cropped to corn, wheat, or rye, and occasionally to alfalfa. The soil is not suited to corn, soybeans, or oats and is better suited to rye than to wheat. If sufficient lime and large applications of commercial fertilizer are made, a mixture of alfalfa and bromegrass probably makes the best pasture. Melons and small tree fruits are somewhat suited. The areas in pasture support a growth of briers, various weeds, and a few scattered shrubs and small trees. There is little attempt to control erosion. This phase is probably best used for forest. Plantings of pine or black locust would probably make good growth.

Plainfield fine sand, severely wind-eroded rolling phase (PM).—This soil occurs on slopes of 5 to 20 percent or more, but the dominant range is from 5 to 12 percent. Over a large part of the soil, practically all of the surface soil and the subsoil to a considerable depth have been removed by wind erosion. Numerous blow-outs (areas where the wind has removed the surface and subsoil for a considerable depth) occur. The material blown from these places has been deposited on adjoining areas and often injures young plants. Little attempt is made to control erosion. This phase has very little agricultural value and under present economic conditions is best used for forest.

Rensselaer loam (RA).—This soil has developed on calcareous stratified layers of sand and silt with some clay and some fine gravel on the glaciofluvial outwash and lake plains. It is the very poorly drained member of the soil catena that also includes the well-drained Jasper, moderately well drained Foresman, imperfectly drained Darroch, and very poorly drained very dark Della soils. Areas occur on nearly level to slightly depressional areas and occasionally on depressed flats. The relief ranges from 0 to 2 percent. Surface runoff is very low, and most of the areas were ponded a part of each year under natural drainage conditions. Most of the areas now have artificial drainage sufficient to permit cropping, but a few need more extensive drainage. Internal drainage is slow. Where outlets are available, artificial drainage is easily accomplished by use of both tile lines and open ditches. Where the subsoil and underlying materials are heavy clay, however, tile lines need to be relatively close together. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray medium granular friable loam; organic content is high and appears to be durable under continuous cultivation; neutral to slightly acid.

8 to 16 inches, very dark-gray to dark-gray heavy loam to silty clay loam; organic content is relatively high in the upper part and decreases some-

what with depth; a few faint yellow mottlings occur in the lower 2 or 3 inches; neutral to slightly acid.

16 to 35 inches, mottled gray, yellow, and brown silty clay loam to sandy clay loam; breaks into coarse block aggregates; plastic when moist and hard when dry; upper 2 or 3 inches show some penetration of the dark materials from the layer above; such penetration often occurs along old root channels and cracks; neutral.

35 to 55 inches, mottled gray, yellow, and brown roughly stratified layers of silt, sand, clay, and some fine gravel; neutral.

55 inches +, calcareous stratified layers of silt, sand, clay, and some fine gravel.

The combined thickness of the dark surface and subsurface layers varies from 12 to about 18 inches. The texture of the subsoil between depths of 16 and 35 inches is somewhat variable, depending upon the sequence of the depositional layers. The thickness and sequence of the lower subsoil and underlying material are also extremely variable in short horizontal distances and from area to area. Where this soil grades to Chalmers loam, the lower subsoil and underlying material are glacial till in some areas. The lower subsoil and substrata are heavy calcareous clay in a few areas adjacent to the Julian soil in the eastern part of the Iroquois Lake Plain.

Use and management.—Rensselaer loam is highly productive of all the general field crops grown in the area. Rotations and management practices are much like those for Rensselaer silt loam and silty clay loam. Corn, soybeans, and oats are the principal crops, but rotations are altered occasionally to include wheat, alfalfa, or a mixture of alfalfa, clover, and grasses. There is some injury to small grains and to hay crops from heaving and drowning-out, and small grains are occasionally damaged by lodging. Use of the newer stiffer strawed varieties of small grains, especially oats, will reduce the loss from lodging.

Rensselaer silt loam (Rb).—This soil of the glaciofluvial outwash and lake plains has developed on calcareous stratified layers of sand and silt with which there is some clay and fine gravel. It is the very poorly drained member of the soil catena that also includes the well-drained Jasper, moderately well drained Foresman, imperfectly drained Darroch, and very poorly drained dark Della soils. The soil occurs on nearly level or depressional areas having 0- to 2-percent slopes in close association with other soils in the catena. Surface runoff is very low, and most areas were ponded a part of each year under natural drainage. For the most part the areas have artificial drainage sufficient for cultivation, but some need more adequate drainage. Internal drainage is slow. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray friable granular silt loam; high organic content; neutral to slightly acid.

8 to 15 inches, dark-gray to very dark-gray friable heavy silt loam to light silty clay loam; organic content relatively high in the upper part but decreases with depth; a few faint yellow mottlings occur in the lower 2 or 3 inches; neutral to slightly acid.

15 to 36 inches, mottled gray, yellow, and brown silty clay loam to clay loam; some penetration of the dark material occurs in the upper 2 or 3 inches; breaks into coarse to very coarse blocky aggregates; neutral.

36 to 54 inches, mottled gray, yellow, and brown roughly stratified layers of sand and silt with some clay and some fine gravel; in thickness and sequence the various layers are decidedly variable within short horizontal distances and from area to area; neutral.

54 inches +, stratified calcareous layers of sand and silt with some clay and some fine gravel.

The total thickness of the dark surface and subsurface layers varies from 12 to about 18 inches. Some areas have a slight covering of silted-in material that washed from surrounding land. The material below a depth of about 40 inches is calcareous glacial till in some places, especially in the western part and along the northern and southern parts of the Iroquois Lake Plain area. Where this soil is associated with Julian soil in the eastern part of the lake plain, the underlying material is heavy calcareous clay.

Use and management.—Rensselaer silt loam occurs in irregularly sized and shaped areas, and its rotations and management practices are governed somewhat by the extent of the associated soils. The rotations in common use are (1) corn, soybeans, and oats with an intercrop of sweetclover and (2) corn and oats with an intercrop of sweetclover. These rotations are altered to include an occasional crop of wheat, alfalfa, or a mixture of alfalfa, clover, and grasses. Where this soil comprises the greater part of or all the field, the rotation often is 2 years of corn and 1 year of soybeans, or corn and soybeans alternated.

If it has adequate artificial drainage, this soil is well suited to all the crops common to the area. Yields are high. The general practice is to use commercial fertilizer with corn, oats, and wheat, but it is infrequently used with soybeans. Lime is not necessary for the successful growth of clover and alfalfa. There is some injury to small grains and hay crops from heaving and drowning-out, and small grains tend to lodge somewhat. The new stiffer strawed varieties, especially of oats, have reduced this loss. Excellent stands of permanent bluegrass pasture are obtained, and the livestock carrying capacity is high. Because of its high productivity for field crops, only a relatively small part of the soil is in permanent pasture.

Rensselaer silty clay loam (Rc).—This soil occurs on glaciofluvial outwash and lake plains and developed on calcareous stratified layers of sand and silt with which some clay and fine gravel are mixed. It is the very poorly drained member of the soil catena that also includes the well-drained Jasper, moderately well-drained Foresman, imperfectly drained Darroch, and very poorly drained very dark Della soils. It occurs in nearly level to depressional areas (0 to 2 percent slopes), often as broad slightly depressed flats. Surface runoff is very low, and most areas were ponded a part of each year under natural drainage. Artificial drainage is necessary for successful crop production. Most areas now have sufficient artificial drainage, but a few need additional drainage. Both tile lines and open ditches are used, and where outlets are available, drainage is easily accomplished in all areas except those underlain by heavy clay. The native vegetation was marsh grasses.

Profile in a cultivated area:

0 to 8 inches, very dark-gray friable medium granular silty clay loam; high organic content; neutral to slightly acid.

8 to 15 inches, very dark-gray to dark-gray heavy silty clay loam; coarse granular to fine blocky structure; organic content relatively high in upper part of layer but decreases with depth; neutral to slightly acid.

15 to 36 inches, mottled gray, yellow, and brown silty clay loam to silty clay; breaks into coarse to very coarse blocky aggregates plastic when

moist and hard when dry; upper 2 or 3 inches is slightly darkened by penetration of material from layer above; neutral.

36 to 54 inches, mottled gray, yellow, and brown roughly stratified layers of silt and sand with which occur layers of clay and an occasional layer of fine gravel; neutral.

54 inches +, mottled gray and pale-yellow calcareous stratified sand and silt with some clay and thin lenses or layers of fine gravel.

The total thickness of the dark surface and subsurface layers ranges from 12 to about 18 inches. The texture of the subsoil is variable and depends largely upon the sequence of the depositional layers. The thickness and sequence of the stratified material below a depth of about 36 inches is decidedly variable in short horizontal distances and between areas. This material in some areas is calcareous glacial till, especially where this soil is associated with Chalmers silty clay loam. Where this soil is associated with the Julian soil, especially in the eastern part of the Iroquois Lake Plain area, the lower subsoil and underlying material are both calcareous clay.

Use and management.—Rensselaer silty clay loam is used for the crops generally grown in the area—corn, soybeans, oats, wheat, and hay. Among these crops corn, soybeans, and oats predominate. Where a field is not composed largely or wholly of this soil, rotations are governed somewhat by the extent of the associated soils. Commercial fertilizer is usually applied to crops of corn, wheat, and oats but its use with soybeans is not common. Where a field consists largely or wholly of this soil, the rotation often is 2 years of corn, 1 year of soybeans, and 1 year of oats. Crop yields are high. Small grains are well suited, but there is some damage from heaving and drowning-out and from lodging of the grain. The use of newer stiffer strawed varieties, especially of oats, has somewhat reduced the damage caused by lodging.

Stockwell loam, undulating phase (SB).—This soil has developed on highly calcareous gravel on upland areas in close association with Parr soils. The relief is undulating with slopes of 2 to 5 percent. In many places the soil occurs at slightly higher elevation than the surrounding soils. Surface runoff is medium to low and internal drainage is moderate to rapid. The native vegetation was tall prairie grasses. This soil may be considered the prairie analog of the Bellefontaine soils, which developed under a forest cover and are not mapped in this county.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown friable loam; relatively high organic content; a considerable number of small pebbles occur on the surface and throughout the layer; medium acid.

7 to 18 inches, dark grayish-brown to dark-brown friable loam to light sandy clay loam; organic content relatively high in upper part but diminishes with depth; friable when moist and slightly plastic when wet; medium acid.

18 to 45 inches, brown gravelly and sandy clay loam; breaks into large irregular-shaped chunks; slightly plastic when moist and hard when dry; considerable gravel and an occasional rounded stone; medium acid.

45 to 50 inches, dark grayish-brown to very dark-brown waxy and gravelly clay loam; darker than layer above; breaks into large irregular-shaped chunks; plastic when moist and hard when dry; slightly acid to neutral.

50 inches +, gray and pale-yellow highly calcareous gravel, usually cross-bedded.

The thickness of the dark surface and subsurface layers varies from 14 to 20 inches or more. The texture of the subsoil is somewhat variable but is usually light clay loam or heavy loam. The depth to calcareous gravel ranges from 40 to 60 inches. The gravel on the surface is variable but never sufficient to interfere with cultivation. Included with this soil are small areas where a part or all of the surface soil and in some instances a part of the subsoil have been removed by erosion. In these included areas the organic content of the present surface soil is much lower than normal and tilth conditions are not so favorable.

Use and management.—Stockwell loam, undulating phase, occurs in relatively small areas closely associated with Parr and Corwin soils. It usually forms only a small part of a field, and rotation practices are therefore largely those used on the associated soils. In organic content this soil is relatively high, but the use of a rotation that includes hay crops and the plowing under of all available organic matter are probably necessary to maintain and increase organic and nitrogen contents. The soil responds well to fertilizer and manure but is moderately erosive under clean cultivation, especially where clean-cultivated crops are grown for several consecutive years.

The rotations include corn, oats or wheat, soybeans, and hay. Corn usually follows hay but it may follow oats or soybeans. A rotation practiced on some areas is corn the first year and then oats with an intercrop of sweetclover. The sweetclover is sown with the oats and plowed under the following spring before the land is planted again to corn. Oats usually follow corn in the rotation and are fairly well suited. Yields of oats are reduced in seasons of low moisture supply because the soil is somewhat droughty. Wheat is probably better suited than oats, as far as the physical characteristics of the soil are concerned, because moisture relations are usually favorable for wheat during the growing season.

Soybeans, a crop fairly extensively grown, follow corn or small grains. Usually soybeans are not fertilized directly; instead heavy applications of commercial fertilizer are made to small grains and the soybeans following in the rotation are indirectly benefited.

Most areas of this soil need applications of lime for the better growth of alfalfa and clover. It is also profitable in many areas to use liberal applications of commercial fertilizer with alfalfa. A few areas are in permanent bluegrass pasture, but the livestock carrying capacity on most of these could be substantially increasing by liming, liberal use of commercial fertilizer, and weed control.

Stockwell loam, eroded sloping phase (SA).—This soil occurs on slopes of 5 to about 12 percent in close association with Parr soils and the undulating phase of Stockwell loam. Erosion has removed a considerable part of the surface soil in most areas. The surface soil is dark brown to yellowish brown, depending upon the quantity of material removed by erosion. Tilth conditions are less favorable to crop growth than on the undulating phase. Included are a few small areas where very little of the surface soil has been removed, and in these the profile characteristics are similar to those of the undulating phase.

Use and management.—Stockwell loam, eroded sloping phase, is usually farmed with Parr soils and with the undulating phase of

Stockwell loam. Crop rotations and management practices are essentially the same as those prevailing on the undulating phase, but because of its slope and susceptibility to erosion under cultivation, this soil possibly should be treated somewhat differently. The crop rotation should include a high percentage of small grains and hay and a low percentage of clean-cultivated crops. The turning under of all available organic material and the use of both lime and commercial fertilizer are necessary to maintain productivity. Erosion control practices, as strip cropping or contouring, or both, should be employed where practical.

Strole loam (Sc).—Surface and subsurface layers of loam texture differentiate this soil from Strole silt loam. It is derived from thin deposits of lighter textured materials on heavy clays and occurs in close association with Strole silt loam, Julian silty clay loam, and the Darroch soils. The slope range is 0 to 2 percent. The surface 8 inches in cultivated areas is very dark brownish-gray to dark brownish-gray friable granular loam high in organic content. Underlying this layer and continuing to a depth of 10 to 16 inches is very dark-gray friable heavy loam to light silt loam. Below this the profile characteristics are esentially the same as those of Strole silt loam. Where Strole loam is associated with Darroch loam the light-textured deposits attain their greatest thickness.

Use and management.—All the field crops common to the area are grown on Strole loam, but corn, soybeans, and oats predominate. Artificial drainage is necessary for successful crop production, and drainage problems are comparable with those on the heavier textured soils. Yields of most crops are equal to or slightly higher than those obtained on Strole silt loam.

Strole silt loam (Sd).—This soil has developed on highly calcareous lacustrine clay. It is the imperfectly drained member of the soil catena that also includes the very poorly drained Julian soil. Surface runoff is low and internal drainage is slow. The slope range is 0 to 2 percent. Artificial drainage is necessary for successful crop production but difficult to establish. Tile lines need to be closely spaced because of the heavy texture and slow permeability of the subsoil and underlying material. The soil is developed under a tall prairie-grass vegetation and may be considered the prairie analog of the Fulton soils (not mapped in this county), which developed under a forest vegetation.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to very dark brownish-gray friable granular silt loam; relatively high organic content; slightly acid.

7 to 14 inches, dark-gray to dark brownish-gray heavy silt loam; coarse granular in upper part and gradually changes to fine nuciform below; organic content relatively high but decreases slightly with depth; some faint-yellow and light-gray mottlings occur in the lower 2 or 3 inches; slightly to medium acid.

14 to 17 inches, dark-gray, mottled with pale-yellow and brown, silty clay loam; breaks into fine blocky aggregates ¼ to ½ inch in diameter and is slightly plastic when moist and hard when dry; some penetration of the dark material occurs along old root channels and in cracks; slightly to medium acid.

17 to 30 inches, mottled yellow, gray, and brown smooth silty clay to clay; breaks into coarse to very coarse blocky aggregates ¾ to 2¼ inches in diameter and is plastic when wet and hard when dry; medium acid to neutral.

30 inches +, mottled pale-yellow, yellowish-brown, and gray highly calcareous smooth clay; breaks into very coarse blocky aggregates; a light-gray coating shows on many surfaces of the cleavage planes.

The thickness of the dark surface and subsurface layers varies from 10 to 16 inches. The organic content is somewhat variable and is lower than normal in a few areas where the forest has encroached upon the prairie.

Use and management.—Strole silt loam is associated with the Julian soil and Darroch silt loam and usually occurs in areas of irregular shape and size. A field rarely consists largely or entirely of this soil, and rotations and management practices are therefore controlled somewhat by the extent of the associated soils. The principal crops are corn and soybeans, but some oats, wheat, and hay are grown. The hay crops are alfalfa or a mixture of alfalfa, clover, and grasses. Crop yields are somewhat lower than those obtained on Darroch silt loam. Artificial drainage is necessary. Tile lines must be spaced closely and must be accurately laid to keep them from filling with silt. Wheat and hay crops are occasionally damaged from heaving.

A considerable part of this soil is in permanent bluegrass pasture. The livestock carrying capacity seems high, but some pastures could be improved by using lime and a commercial fertilizer relatively high in phosphate and by controlling weeds.

Swygert loam (Se).—This soil is derived from a thin overburden of loam material on silty clay glacial till. The thickness of the overburden ranges from 10 to about 16 inches. The soil is associated with members of the Parr catena and with Clarence soils. It occurs on slopes of 1 to 3 percent. The surface 6 to 8 inches is dark-gray to dark brownish-gray friable loam high in organic content. The upper subsoil, to a depth of about 14 inches, is dark-gray to dark brownish-gray heavy loam to silt loam. Below the upper subsoil the profile is comparable with that of Swygert silt loam.

Use and management.—Swygert loam is used for the same crop as the associated soils because it occurs with them in small isolated areas. It is somewhat better suited to the common field crops than Swygert silt loam, but its silty clay subsoil and underlying material retard movement of air and water and are somewhat impermeable to plant roots. Yields are a little higher than those obtained on Swygert silt loam. Erosion is a problem of some importance on the stronger slopes, especially if the rotations are made up predominantly of clean-cultivated crops.

Swygert silt loam (Sf).—This soil has developed on heavy-textured calcareous glacial till of Late Wisconsin age and is surrounded by the lighter textured glacial till dominant in the Marseilles moraine section. It occurs in small scattered areas in close association with the Parr, Corwin, and Clarence soils. Relief ranges from 1 to 3 percent. Surface runoff is medium and internal drainage is slow. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark brownish-gray to dark-gray friable silt loam of fine to medium granular structure; relatively high organic content; slightly to medium acid.

7 to 13 inches, dark brownish-gray to dark-gray heavy silt loam; coarse granular to fine nuciform structure; organic content somewhat lower than in the layer above; slightly to medium acid.

13 to 18 inches, medium grayish-brown silty clay to clay; breaks into blocky aggregates ¼ to 1½ inches in diameter and is plastic when moist and hard when dry; slightly to medium acid.
18 to 25 inches, mottled yellow, gray, and brown clay to silty clay; coarse to very coarse blocky structure; medium to slightly acid.
25 inches +, mottled yellow, brown, and gray calcareous silty clay.

The total thickness of the dark surface and subsurface layers varies from 8 to about 15 inches. The depth to mottling ranges from 16 to about 22 inches, and the depth to calcareous till from 22 to about 28 inches.

Use and management.—Swygert silt loam is used for almost all the general farm crops, but corn, soybeans, and oats are predominant. The heavy-textured subsoil restricts movement of water and air and the root penetration of crops. The soil is subject to erosion, especially under clean cultivation. Crop yields are intermediate between those obtained on the Foresman soils and those produced on Clarence loam.

Tippecanoe loam (TA).—Areas of this soil occur on glaciofluvial outwash and have developed on highly calcareous stratified gravel and coarse sand. Relief is nearly level; slopes range from 0 to 2 percent. Surface runoff is low to very low. Internal drainage is moderate in the upper part and slightly restricted in the lower. Artificial drainage is not necessary for crop production. The native vegetation was tall prairie grasses.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown to very dark grayish-brown friable granular loam; high organic content; slightly to medium acid.
7 to 18 inches, dark grayish-brown to dark brownish-gray gritty friable loam containing many small pebbles; organic content is relatively high in the upper part and decreases somewhat with depth; medium acid.
18 to 23 inches, brown heavy loam containing many small pebbles and rounded rock fragments; medium to strongly acid.
23 to 47 inches, mottled gray, yellow, and brown sandy or gravelly clay loam, the yellow color predominating; breaks into large irregular-shaped chunks, slightly plastic when moist and hard when dry; contains considerable gravel and an occasional rounded stone; medium to strongly acid.
47 to 52 inches, dark-brown, pale-yellow, and gray gravelly clay loam; color in general is darker than that of the layer above; neutral.
52 inches +, gray and pale-yellow highly calcareous gravel and coarse sand.

The thickness of the darker surface and upper subsoil layers varies from 15 to 22 inches. The depth to calcareous gravel and sand varies from 40 to 55 inches.

Use and management.—Tippecanoe loam occurs in association with Chalmers, Maumee, Parr, and Granby soils, and the rotations used are usually governed largely by the extent of the associated soils. Corn, soybeans, and oats are the principal crops, although the rotations are altered to include wheat and hay. The hay crops are principally alfalfa grown alone or a mixture of alfalfa, clover, and timothy. Crop yields are medium to high. Oats are occasionally injured by the droughtiness of the soil late in summer.

Liming is usually necessary for successful growth of both clover and alfalfa. Alfalfa is probably better suited than clover, as it is able to withstand the somewhat droughty condition existing late in summer and in fall. A few areas are in permanent bluegrass pasture, and some of these need liming and fertilizing.

Tuscola loam, undulating phase (TB).—This soil occurs in close association with the other phases of Tuscola silt loam. Slopes range from 2 to 5 percent. Surface runoff is medium and internal drainage is moderate. The surface 6 to 8 inches in cultivated areas is grayish-brown to yellowish-brown friable loam relatively low in organic content. This layer is underlain by brown or yellowish-brown heavy loam that gradually changes to clay loam or light silty clay loam. Below a depth of 30 inches the profile characteristics are similar to those of Tuscola silt loam, eroded undulating phase.

Included with the soil are small areas where 25 percent or more of the original surface soil has been removed by erosion, and in these the present surface soil is yellowish-brown to brownish-yellow heavy loam low in organic content.

Use and management.—Corn, soybeans, wheat, oats, and hay are the principal crops grown on Tuscola loam, undulating phase. Satisfactory yields can be obtained under good management. Good management includes using a rotation in which the percentage of hay crops and small grains is large, plowing under of large quantities of organic matter, liming where necessary, and liberally using commercial fertilizer.

Tuscola silt loam, eroded undulating phase (TC).—This soil occurs adjacent to the bottom lands of the Iroquois River where trees have encroached upon the former prairie areas. It has slopes of 2 to 5 percent, is well drained, and has developed on calcareous stratified layers of sand and silt with some clay and gravel. It may be considered the forested equivalent of the Jasper soils. A considerable part of the surface soil has been removed from many of the areas by erosion. This soil is the well-drained member of the catena that also includes the imperfectly drained Kibbie soils. Surface runoff is medium and internal drainage is moderate. The native vegetation was oak, maple, elm, hickory, and associated species.

Profile in a cultivated area:

0 to 7 inches, grayish-brown to brown friable silt loam; relatively low organic content; fine to medium crumb structure; slightly to medium acid.

7 to 15 inches, brown to yellowish-brown heavy silt loam to light silty clay loam; coarse crumb structure in the upper part gradually changes to fine nuciform below; medium acid.

15 to 35 inches, brown to yellowish-brown heavy silt loam to silty clay loam; breaks into coarse to very coarse nuciform aggregates; contains small pockets and streaks of fine sandy material; medium acid.

35 to 60 inches, yellowish-brown roughly stratified layers of silt and fine sand with some clay and some fine gravel; medium acid in upper part but gradually changes to slightly acid in the lower.

60 inches +, yellowish-brown to pale-yellow calcareous stratified layers of silt, fine sand, and clay with some fine gravel.

Where this soil grades to Jasper soils, the surface soil is darker and the organic content is somewhat higher than normal. The degree of erosion is somewhat variable, and the individual areas have a somewhat spotted appearance because of the contrast in color between the slightly eroded and the eroded patches. The thickness and sequence of the various layers below a depth of about 30 inches is distinctly variable. In a few areas the material below a depth of 40 inches is smooth calcareous clay, and in others there is fine gravelly material below that depth. Included with this soil are a few small areas in forest that have been very little affected by erosion.

Use and management.—The rotation used on Tuscola silt loam, eroded undulating phase, is made up principally of corn, oats, soybeans, and hay. Replenishment of organic matter and nitrogen is essential to the improvement of tilth conditions and to the maintenance and improvement of productivity. The soil is moderately erosive under clean cultivation, and care should be exercised in planning the rotation. Clean-cultivated crops should make up the smaller part of the rotation; small grains, hay, or like crops should be predominant. Under good management practices good yields of crops can be obtained. Good management includes use of crop rotations, the turning under of organic matter, use of lime where necessary, and the liberal application of commercial fertilizer thoroughout the rotation.

Tuscola silt loam, moderately steep phase (TD).—Slopes for this phase range from 12 to 20 percent or more. On the slightly eroded areas profile characteristics are similar to those of the eroded undulating phase, except the surface layer is somewhat higher in organic content and the various other layers are thinner. Included with this phase are areas where a considerable part of the surface soil has been removed by erosion and other areas where a part of the subsoil has been removed.

Use and management.—Small areas of Tuscola silt loam, moderately steep phase, especially those having milder slopes, are cultivated to the crops common to the area. These small bodies usually occur between areas of the other Tuscola soils and the alluvial flood plains. Moisture relations are not so good as on the undulating phases, and erosion is potentially severe. This soil is best used for bluegrass pasture or alfalfa, or on the steeper slopes, for forest.

Wabash silt loam (WA).—From Wabash silty clay loam this soil differs largely in having a silt loam surface texture and a lighter textured subsoil. It occurs in association with Wabash silty clay loam and Kaskaskia silt loam on the flood plains of the Iroquois River and its tributaries. The slope range is 0 to 2 percent. Drainage is somewhat imperfect, and the soil usually occurs back from the stream channels and adjacent to the slopes of the upland or along smaller streams where it is cut frequently by the main stream channel or by old channels. To a depth of 20 to 36 inches the soil is very dark-gray friable silty loam to heavy silt loam high in organic matter. Below this depth is mottled gray, yellow, and brown heavy silt loam to silty clay loam in which occurs an occasional thin layer of sandy material.

Use and management.—Only small areas of Wabash silt loam are under cultivation to corn, soybeans, and oats. The soil is well suited to corn and soybeans, and yields are high provided drainage is adequate. It is not so well suited to oats because there is danger of drowning-out and lodging. For the most part the soil is in bluegrass pasture or woodland pasture.

Wabash silty clay loam (WB).—This moderately well to imperfectly drained soil is in the areas of soils developed under prairie grass vegetation and developed on calcareous till and outwash material. It occurs on the flood plains of the Iroquois River and its

tributaries and is there associated with Wabash and Kaskaskia silt loams. The slope range is 0 to 2 percent. Surface runoff is low, and floodwater remains on this soil a longer time than on the Kaskaskia soil.

Profile description:

0 to 12 inches, very dark-gray silty clay loam; coarse granular structure; high organic content; neutral to slightly acid.
12 to 30 inches, very dark-gray silty clay loam of coarse granular structure; high organic content; neutral to slightly acid.
30 to 36 inches, very dark-gray to dark-gray silt loam to silty clay loam; organic content is relatively high but diminishes somewhat with depth; a few yellow and light-gray mottlings occur in the lower 2 or 3 inches; breaks into coarse granules or pieces of irregular size and shape that are friable to slightly plastic when moist; neutral.
36 inches +, mottled light-gray, pale-yellow, and brown silty clay loam; breaks into irregular-sized angular pieces, firm when moist and hard when dry; neutral.

The total thickness of the dark surface and upper subsoil layers varies from 20 to 36 inches. The subsoil below a depth of 24 to 30 inches is usually silty clay loam, but in a few areas it is silt loam or silty clay loam with thin layers of fine sandy material.

Use and management.—Wabash silty clay loam usually occurs in long narrow areas between the stream channels and the slopes of the upland, and the stream itself or its old channels cut across these areas. Cultivation is difficult, as fields must be very small, and drainage is inadequate. The areas under cultivation are cropped to corn, soybeans, and oats. The soil is highly productive of these crops, and high yields are obtained where drainage is adequate. There is some damage to oats through lodging of the grain, but use of the stiffer strawed varieties will probably lessen this loss somewhat. Most of the soil is in bluegrass pasture or in woodland pasture that supports a sparse growth of trees.

Weiss fine sand (Wc).—This soil has developed on calcareous loose sand of the outwash and lake plain areas. It occurs in association with Conrad and Wooten soils on relief of 0 to 2 percent. The areas are only a few feet above the level of the associated Conrad soils. This soil has essentially the same profile characteristics as the Morocco soils, but from the surface down it ranges from neutral to slightly alkaline instead of from strongly to very strongly acid. The change from neutral to calcareous is gradual. Surface runoff is very low. Drainage, where necessary, is easily accomplished by lowering the general water table in the area. In fact, a large part of the soil is now somewhat excessively drained because associated dark soils have been drained. After the water table has been lowered the movement of moisture through the profile is very rapid. The native cover was forest consisting principally of oak and elm with some poplar and birch.

Profile in a cultivated area:

0 to 8 inches, light brownish-gray loose loamy fine sand; low organic content; neutral to calcareous; a few areas have small hard lime and iron concretions on the surface.
8 to 60 inches +, mottled light-gray and yellow fine sand to sand; mottling becomes more intensive to a depth of about 36 or 40 inches; calcareous.

Included with this soil are a few small areas of Weiss fine sand, wind-eroded phase. Wind has removed most of the surface soil and a part of the subsoil from these included areas, and there is an occasional small blow-out, or place where the wind has removed the subsoil to the depth of 3 or 4 feet or more.

Use and management.—Little attempt has been made to cultivate Weiss fine sand until relatively recent years. A few areas have been planted to sweetclover, and fair stands have been obtained. The greater part of the land is in forest or is idle and covered with a sparse growth of weeds, briers, and a few shrubs. This soil is very susceptible to wind erosion, especially under clean cultivation, and is not well suited to corn, soybeans, oats, and wheat because it is droughty and extremely low in natural fertility.

Weiss fine sand, wind-eroded phase (WD).—This phase consists of areas, formerly of Weiss fine sand, from which a large part or all of the surface soil and a considerable part of the upper subsoil have been removed by wind erosion. Blow-outs (areas where the wind has removed the subsoil to a depth of 3 or 5 feet or more) are numerous. The relief range is 0 to 2 percent.

Use and management.—No attempt is now made to cultivate Weiss fine sand, wind-eroded phase. Most areas are idle, and in the past little attempt has been made to check erosion. Recently, however, attempts have been made to establish plantings of pine and locust on some of the areas. If such plantings can be established, the soil is probably best used for forest.

Wooten fine sand (WE).—This soil has developed on deposits of yellow and gray sand over dark-gray or nearly black sandy material. It occurs on relief of less than 5 percent, usually as low dunelike areas within or adjacent to areas of Conrad soil. Most slopes are between 0 and 2 percent. The soil is usually only a few feet above the lower lying adjacent soils. Surface runoff is very low; internal drainage is very rapid after the water table has been lowered. The native vegetation was principally oaks.

Profile description:

0 to 3 inches, dark-gray fine sand with just enough organic matter to darken the material somewhat; medium to slightly acid.
3 to 30 inches, grayish-yellow or pale-yellow loose fine sand with brown and light gray streaks and mottles; medium acid.
30 to 37 inches, dark-gray fine sand to loamy fine sand with streaks of light-gray fine sand; organic content considerably higher than in the layer above; medium to slightly acid.
37 to 50 inches, dark-brown peaty and mucky material occurring in thin felty platelike pieces; medium acid.
50 inches +, gray fine sand to sand mottled with yellow and brown; contains thin layers and streaks of dark gray sand higher in content of organic matter than the rest of the material; neutral.

The thickness and sequence of the light and the dark layers of sandy material and the thickness and depth of the mucky and peaty layers usually present are variable within short horizontal distances and between areas.

Use and management.—Little attempt has been made to cultivate Wooten fine sand, and where attempts have been made, crop yields

have been extremely low. The content of both organic matter and plant nutrients is very low, and many of the areas are too droughty for successful crop production. Most of the land is now in forest or is idle and covered with a sparse growth of weeds, briers, and brush.

Wooten fine sand, wind-eroded phase (Wf).—This phase occurs in close association with Wooten fine sand but differs from it in having lost much of the surface soil and in many places a considerable part of the subsoil through wind erosion. There are many small blow-outs—areas where the subsoil has been removed to a depth of 3 to 5 feet or more—and occasionally larger ones.

Use and management.—No attempt is made to cultivate Wooten fine sand, wind-eroded phase. It is in low grade pasture or is idle and covered with a sparse growth of briers, weeds, and some shrubs. Probably stands of pine and possibly locust could be established on some of this soil. Such a forest cover would aid in controlling erosion and in stabilizing the soil.

USE, YIELDS, AND PRODUCTIVITY RATINGS OF NEWTON COUNTY SOILS

The percentage of each soil used for various purposes in 1940–41 is given in table 6. These data were obtained at the time of survey and compiled by the Purdue University Agricultural Experiment Station.

Average acre yields of principal crops to be expected over a period of years are estimated for each soil of the county in table 7. In columns A of this table are estimates of yields to be obtained under prevailing management, or that most commonly used; columns B give estimated yields under better management practices.

The common, or prevailing, management specified for yields in columns A includes the use of commercial fertilizer in moderate but insufficient amounts; use of regular crop rotations in which the proportion of clean-cultivated crops is usually too high; the use of artificial drainage where necessary; the application of lime, but not in sufficient quantity; and the use of barnyard and green manures.

The better management specified for estimated yields in columns B requires use of crop rotations in which the proportion of clean-cultivated crops is properly related to that of the legume hay crops, as alfalfa and clovers; application of lime in the quantity ascertained by accurate soil tests; addition of commercial fertilizer according to the plant-nutrient requirements of a particular crop or for all crops in the rotation; installation of adequate artificial drainage where necessary; use of high-quality seed from improved crop varieties; and use of contour tillage, strip cropping, diversion ditches, windbreaks, and special vegetation to control erosion where needed.

Table 8 gives the productivity ratings of the soils of the county. The soils are listed in descending order of productivity for corn, that is, the most productive first, the least productive last.

TABLE 6.—*Uses of Newton County, Ind., soils, 1940–41*

[Average for county, all soils combined: Corn, 24.4 percent; oats, 12.4; wheat, 2.4; rye, 1.2; soybeans, 10.2; miscellaneous grain crops, 1.
0.5; miscellaneous hay, 1.0; sweetclover, 0.7; truck crops, 0.3; idle land, 1.9; seriously eroded land, 0.3; first grade permanent
third-grade permanent pasture, 5.7; miscellaneous pasture, 0.2; wooded pasture, 3.5; oak-hickory forest, 3.8; beech-maple fores
restocking, 2.7; tree fruits, 0.1; other uses, 2.7. Blank spaces in columns indicate less than 0.1 percent of a given soil is used f

Soil	Corn	Oats	Wheat	Rye	Soybeans	Miscellaneous grain crops	Clover	Timothy	Mixed hay	Alfalfa	Miscellaneous hay	Sweetclover	Truck crops	Idle land [1]	Seriously eroded land [2]	Permanen	
																First grade	Second grade
	Per-cent	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per cent*
Ade fine sandy loam, undulating phase	36.0	16.9	6.7	____	12.9	0.2	1.4	____	____	____	____	0.2	0.5	0.7	____	13.3	3.
Ade loamy find sand, undulating phase	38.7	22.7	2.0	____	16.9	.4	1.2	____	____	2.0	0.8	.8	.4	.8	____	5.9	3.
Alida loamy fine sand	24.7	8.1	1.9	____	13.8	____	____	____	____	1.0	____	____	____	5.7	____	____	20.
Ayr fine sandy loam:																	
Eroded undulating phase	27.3	30.3	____	____	19.2	____	____	____	____	1.0	____	____	____	9.1	____	8.1	____
Undulating phase	41.2	19.2	4.4	____	12.4	.2	2.4	____	____	.9	____	____	____	1.2	____	11.9	2.
Berrien loamy fine sand	8.0	.2	.7	0.4	4.5	.9	____	0.4	____	.1	.8	____	.6	2.7	0.2	5.7	12.
Severely wind-eroded phase	3.9	____	____	____	____	____	____	____	____	____	.6	____	.3	3.0	____	____	____
Wind-eroded phase	33.9	8.6	.9	____	4.7	____	____	____	____	3.8	3.8	____	____	15.2	____	.9	17.
Bridgman sand, wind-eroded undulating phase	.3	____	____	____	____	____	____	____	____	____	____	____	____	____	64.0	.6	1.
Chalmers loam	45.3	19.3	1.9	____	14.9	1.6	.9	____	____	.4	7.9	____	____	____	____	5.6	____
Chalmers silt loam	43.5	22.7	2.9	.5	13.8	.4	2.4	.2	0.4	.5	____	.3	.1	.9	____	8.2	2.
Chalmers silty clay loam	39.1	21.7	3.1	.3	14.1	.1	5.2	.7	.9	.9	____	2.4	.1	.4	____	8.4	1.
Clarence loam	40.0	28.0	1.3	____	18.7	____	4.0	____	____	____	____	____	____	1.3	____	____	6.
Clarence silt loam	27.0	28.1	2.5	____	17.1	____	9.6	.7	____	.7	____	____	____	1.8	____	10.7	____
Clyde silty clay loam	27.6	16.6	.3	____	17.2	.7	.7	____	____	____	____	.7	____	2.4	.3	25.6	1.
Coloma loamy fine sand:																	
Undulating phase	14.3	10.2	.8	____	9.4	1.5	4.4	.2	.6	.2	____	____	.6	____	____	21.1	8.
Wind-eroded undulating phase	26.1	13.1	2.5	____	13.8	____	____	____	____	____	____	____	____	____	.6	____	17.
Conrad fine sand	6.4	.3	.9	____	3.7	.4	____	.3	____	____	14.0	____	____	.9	6.0	9.0	19.
Corwin loam	35.9	22.7	3.1	____	13.7	.3	.7	.2	.7	.5	____	.3	.3	.2	____	13.7	2.
Corwin silt loam	38.0	16.4	4.5	____	14.0	.6	4.4	.6	.6	1.0	____	2.1	.1	.2	____	9.3	1.
Crosby silt loam	24.3	15.5	4.0	____	10.3	____	4.0	.9	2.3	.4	____	.2	.4	.4	____	13.2	1.
Darroch fine sandy loam	34.4	21.7	1.4	3.2	14.4	____	5.0	1.4	1.8	.9	____	.9	____	____	____	5.9	3.

Darroch loam	38.9	21.6	3.0	.1	11.6	.9	5.2	1.0	.9	.6	----	1.2	.1	1.0	.1	9.1	1.
Darroch silt loam	43.3	22.6	2.7	.1	12.1	.2	5.0	.5	.7	1.2	----	1.0	----	.5	----	7.2	1.
Deardurff fine sandy loam	37.5	16.3	6.3	----	12.4	.9	.3	----	.8	----	.8	----	1.4	.4	----	12.5	7.
Della silty clay loam	36.3	20.0	1.3	----	12.7	4.8	2.8	----	.3	----	4.4	1.5	----	1.9	.3	10.3	.
Dillon fine sandy loam	36.7	5.7	1.8	.1	8.1	1.7	----	.7	----	----	1.8	----	.7	3.9	.6	4.3	12.
Dillon loamy fine sand	10.3	6.7	----	10.9	6.1	3.6	----	.6	----	----	1.8	----	----	----	----	1.2	6.
Edwards loamy muck	62.3	----	1.1	----	17.8	11.1	----	----	----	----	----	----	1.1	----	----	1.1	4.
Edwards muck	48.6	3.1	1.1	----	12.3	.7	----	----	----	----	.3	----	1.5	5.1	----	18.8	8.
Burned phase	15.5	3.8	1.1	----	3.0	9.5	1.1	----	----	----	4.2	----	----	10.2	----	2.3	11.
Foresman fine sandy loam	29.1	15.4	1.2	----	17.0	.8	1.2	.7	2.4	.2	----	3.0	----	.1	----	17.1	4.
Foresman loam	32.3	20.8	3.0	.2	12.8	.3	3.6	.2	.7	1.5	----	.6	.2	.4	----	15.8	1.
Foresman silt loam	37.4	23.7	4.1	----	11.3	.9	5.3	.3	.8	1.0	----	1.7	----	1.0	----	5.3	.
Granby fine sandy loam	24.7	8.7	4.5	.2	10.4	2.4	.1	.5	----	----	2.2	.1	.7	2.7	.1	6.0	20.
Mucky subsoil phase	36.7	18.4	2.6	.1	10.3	11.5	----	----	----	----	.4	----	----	.1	.4	2.9	12.
Granby loamy fine sand	36.1	7.3	3.2	1.5	8.7	1.4	----	.9	----	----	.8	----	.7	7.3	----	3.3	13.
Gravel and sand pits	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
Griffin fine sandy loam	1.6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	13.
Griffin loam	12.2	----	----	----	1.1	----	----	----	----	----	2.9	----	----	.1	----	----	1.
Griffin loamy fine sand	2.3	.3	----	----	.8	----	----	----	----	----	----	----	----	----	----	----	9.
Hagener fine sandy loam, undulating phase	32.4	14.8	2.8	----	16.2	1.1	.4	.7	----	1.3	.1	.1	.4	.7	----	16.2	1.
Hagener loamy fine sand:																	
Undulating phase	12.5	12.9	2.0	3.4	17.6	.7	.7	----	1.7	1.0	----	.3	.3	----	.3	21.6	10.
Wind-eroded rolling phase	28.8	1.7	----	3.4	1.7	----	----	----	3.4	16.9	----	----	----	----	----	28.8	1.
Houghton loamy muck over sand	14.7	17.7	----	2.4	7.3	----	----	9.0	----	----	----	----	----	2.0	----	9.0	20.
Houghton muck	32.3	2.0	1.2	.3	5.7	----	11.1	.9	----	----	.3	----	10.2	9.8	----	8.4	7.
Burned phase over sand	6.4	6.4	1.0	----	1.9	2.9	----	----	----	----	.2	----	2.7	2.9	----	5.4	7.
Shallow phase over sand	34.6	9.2	.1	.3	6.8	.9	----	.1	----	----	1.2	----	5.0	8.6	----	20.0	6.
Jasper fine sandy loam:																	
Eroded sloping phase	36.0	14.0	2.3	----	3.5	1.2	2.3	----	----	----	----	----	----	----	----	23.2	2.
Undulating phase	27.6	22.5	5.7	----	13.1	----	1.4	----	.9	.5	----	1.1	.2	.3	----	12.9	2.
Jasper loam:																	
Eroded sloping phase	1.4	6.6	----	2.4	6.6	17.2	10.5	----	----	----	----	----	----	----	----	33.2	2.
Eroded undulating phase	33.5	32.5	2.1	.3	9.4	----	----	----	1.1	1.1	----	----	----	8.4	----	11.6	----
Undulating phase	38.5	----	3.2	----	10.6	.3	6.9	.4	2.3	.9	----	1.0	.4	.6	----	17.5	2.
Jasper silt loam:																	
Eroded sloping phase	15.5	13.3	1.5	3	3.7	----	----	1.5	----	----	----	----	----	----	----	29.1	5.
Eroded undulating phase	28.8	38.2	----	----	5.0	----	4.3	----	----	1.4	----	----	----	----	----	13.7	3.
Undulating phase	27.0	24.2	.5	----	7.7	----	2.8	1.2	1.4	.9	----	.2	----	1.6	----	16.6	1.
Julian silty clay loam	54.8	.8	2.3	----	18.2	.5	9.4	.4	----	1.7	----	1.0	----	1.3	.1	7.7	.
Kaskaskia silt loam	15.1	6.3	.3	----	4.1	----	----	----	2.6	----	.5	----	.3	1.3	----	29.3	3.
Kibbie loam	22.3	8.4	1.1	----	11.1	.9	3.2	----	.2	1.1	----	1.3	.4	.4	----	16.4	4.
Kibbie silt loam	21.6	12.9	6.2	----	7.2	----	3.8	.3	----	1.1	----	----	----	4.3	----	9.8	.
Maumee fine sandy loam	25.7	11.2	3.5	.8	16.5	2.4	.2	1.3	----	----	1.5	----	.3	2.4	----	7.5	18.
Ferruginous phase	17.1	11.8	7.9	5.4	21.1	----	----	1.3	----	----	----	----	----	7.8	----	18.0	5.
Mucky subsoil phase	38.7	12.8	4.5	----	13.8	9.3	----	----	----	----	.3	----	----	.8	----	5.7	4.
Maumee loam	25.9	12.4	5.6	.5	8.7	2.0	.1	.2	----	----	.9	----	.6	5.5	----	17.6	8.
Maumee loamy fine sand	33.2	15.6	4.0	.9	10.7	2.2	----	.2	----	----	.7	----	.4	2.2	----	5.4	15.

See footnotes at end of table.

TABLE 6.—*Uses of Newton County, Ind., soils, 1940–41*—Contin

Soil	Corn	Oats	Wheat	Rye	Soybeans	Miscellaneous grain crops	Clover	Timothy	Mixed hay	Alfalfa	Miscellaneous hay	Sweetclover	Truck crops	Idle land [1]	Seriously eroded land [2]	Permaner	
																First grade	Second grade
	Per-cent	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*	*Per-cent*
Miami silt loam:																	
Eroded sloping phase	11.5	5.1	5.1	----	6.4	----	2.6	7.7	1.3	----	----	----	2.6	1.3	2.6	25.5	7.
Eroded undulating phase	26.5	15.5	1.8	----	12.7	----	14.5	2.7	----	----	----	----	----	1.8	1.8	6.4	----
Moderately steep phase	2.6	1.3	2.0	----	5.9	----	2.0	----	.7	1.3	----	----	----	1.3	----	34.5	3.
Undulating phase	14.7	12.8	4.7	----	3.5	.8	----	----	.4	----	----	.4	1.2	----	----	24.1	2.
Morocco fine sandy loam	17.3	4.1	3.7	----	10.9	.3	----	----	----	----	----	----	.3	.3	----	18.1	17.
Morocco loamy fine sand	9.1	2.7	1.0	.5	4.0	1.5	1.0	.3	----	----	2.0	----	.7	3.3	.1	2.7	13.
Newton fine sandy loam	25.5	4.2	.8	.5	8.1	1.5	----	.7	----	----	5.3	----	.6	3.7	.1	2.9	11.
Newton loamy fine sand	16.6	7.6	1.3	.5	5.0	5.0	----	----	----	----	.2	----	----	3.2	.2	1.7	22.
Odell loam	37.9	19.8	4.3	.2	15.5	.5	3.1	.3	.1	.5	----	.2	----	.9	----	11.5	3.
Odell silt loam	39.0	20.7	2.6	----	15.5	.3	4.9	.2	.5	1.4	----	1.3	.2	.4	----	7.4	1.
Parr fine sandy loam, undulating phase	32.8	16.3	6.4	1.2	22.9	----	2.3	----	----	----	----	----	----	----	----	15.8	----
Parr loam:																	
Eroded sloping phase	32.7	24.3	2.8	----	17.5	.4	5.6	1.2	.4	1.9	----	.4	----	1.2	----	6.8	3.
Eroded undulating phase	34.0	26.8	2.4	----	14.7	.6	2.5	1.6	----	.1	----	.3	.1	1.6	----	8.1	2.
Severely eroded undulating phase	35.2	4.9	1.9	----	32.4	----	----	----	----	----	----	1.9	----	.9	----	18.7	1.
Undulating phase	6.8	38.7	6.1	.1	21.3	.4	3.8	1.1	.7	.7	----	.6	.2	.9	----	2.1	5.
Parr silt loam:																	
Eroded moderately steep phase	16.6	1.7	1.7	----	3.6	----	.7	----	----	2.6	----	2.6	----	----	----	45.4	----
Eroded sloping phase	25.3	16.7	1.9	----	4.3	----	2.5	.5	----	1.2	----	1.2	----	3.1	----	31.5	2.
Eroded undulating phase	35.8	8.2	2.6	----	20.3	1.0	6.8	----	----	2.2	----	3.1	2.9	.5	----	11.5	1.
Undulating phase	33.1	18.4	3.9	----	11.9	.5	4.2	.4	.9	1.0	----	2.8	.3	.6	----	12.0	1.
Plainfield fine sand:																	
Rolling phase	1.4	.3	.1	----	.5	----	----	----	----	----	.5	----	.4	.5	----	2.6	7.
Severely wind-eroded rolling phase	4.9	.3	.3	.3	.8	2.4	----	----	----	----	1.6	----	.5	5.7	8.7	5.1	16.
Severely wind-eroded undulating phase	14.1	2.3	.9	----	3.2	1.8	1.4	----	----	----	2.8	----	----	6.8	46.6	----	8.
Undulating phase	4.7	1.5	.7	.2	1.6	.3	----	----	----	----	.3	----	.4	1.7	----	3.1	9.
Wind-eroded rolling phase	5.4	.9	.9	.1	1.5	.6	.1	----	----	.1	.2	----	.3	2.2	1.8	3.7	12.
Wind-eroded undulating phase	8.2	4.5	----	.6	3.0	----	----	1.2	----	.3	----	----	.6	3.3	1.8	3.6	19.

Rensselaer loam	35.2	15.7	3.5		12.4	1.5	3.3	1.8	1.1	.9		1.5	.2	.2		16.3	5.
Rensselaer silt loam	41.5	21.0	3.8	.2	12.5	.4	5.5	.5	.9	.7		1.9		.4	.1	6.6	1.
Rensselaer silty clay loam	42.5	26.8	2.5		2.1	10.8	4.8	.3	.2	.5		1.2		.9		5.1	1.
Stockwell loam:																	
Eroded sloping phase					23.5		17.6			35.4						23.5	
Undulating phase	26.5	12.5	1.7		16.0		2.3	1.1	2.9	2.3						16.5	5.
Strole loam	33.5	30.9	3.7		22.7		2.5	.5					.5			4.7	
Strole silt loam	32.0	23.9	.9		13.0	.3	5.9	.2		1.5		.4		.1		9.7	
Swygert loam	36.6	46.3			17.1												
Swygert silt loam	32.3	20.9	6.5		25.8					3.2				1.6		6.5	
Tippecanoe loam	11.9	17.1	16.5		18.5	5.7				3.8				.5		19.9	3.
Tuscola loam, undulating phase	32.4		13.9		5.7		2.3	4.6	3.4							3.4	6.
Tuscola silt loam:																	
Eroded undulating phase	24.1	14.1	2.8		7.0	1.4	4.2							1.4		18.4	5.
Moderately steep phase	15.7				6.4				1.5					6.4		28.0	4.
Wabash silt loam	5.5	1.3	.1		1.8	.1	.2	.1		.1		.2				41.6	5.
Wabash silty clay loam	4.0		.8		2.5		1.2							5.6		16.7	20.
Weiss fine sand	5.3	.8	2.4		2.4						2.1			.5	1.1	4.2	11.
Wind-eroded phase	1.3	1.7			.2			.4			4.0			2.9	3.4	.2	4.
Wooten fine sand	.4	1.4	.2		1.3						6.9			2.2	.4	8.2	7.
Wind-eroded phase	4.0				1.0						33.5				10.0	5.0	28.

[1] Arable land not under cultivation or in pasture or forest in 1940–41.

[2] Land so eroded that cropping is not feasible.

[3] First-grade permanent pasture is 80 percent or more bluegrass and clover; second-grade, 50 to 80 percent bluegrass and clover; third-grade, less than 50 percent bluegrass and clover.

[4] Areas where trees are far enough natural forest reproduction is not de

[5] Land used for all other crops and and cemeteries.

[6] Nonagricultural.

TABLE 7.—*Estimated average acre yields of principal crops on each soil of Newton management.*

[In columns A—yields under common, or prevailing management; in columns B—yields under bet crop is not generally grown or is unsuited to the soil]

Soil	Hybrid corn		Wheat		Oats		Soybeans	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu*
Ade fine sandy loam, undulating phase	20	30	9	13	22	27	8	1
Ade loamy fine sand, undulating phase	18	27	8	11	18	22	7	1
Alida loamy fine sand	10	15	6	9	----	----	7	1
Ayr fine sandy loam:								
Eroded undulating phase	25	28	9	13	20	25	10	1
Undulating phase	30	40	12	17	30	37	15	2
Berrien loamy fine sand	15	25	6	10	----	----	6	1
Severely wind-eroded phase	----	----	----	----	----	----	----	
Wind-eroded phase	10	20	4	7	----	----	4	
Bridgman sand, wind-eroded undulating phase	----	----	----	----	----	----	----	
Chalmers loam	45	60	22	30	45	60	25	3
Chalmers silt loam	50	65	22	30	45	60	25	3
Chalmers silty clay loam	50	65	22	30	45	60	25	3
Clarence loam	42	50	15	18	40	47	19	2
Clarence silt loam	40	47	14	18	40	47	19	2
Clyde silty clay loam	45	60	13	16	22	32	19	2
Coloma loamy fine sand:								
Undulating phase	15	20	8	11	10	15	6	1
Wind-eroded undulating phase	10	15	6	9	----	----	5	
Conrad fine sand	----	----	----	----	----	----	----	
Corwin loam	40	55	17	22	45	55	20	2

Corwin silt loam	40	55	17	22	45	55	20	2
Crosby silt loam	40	55	15	20	35	45	17	2
Darroch fine sandy loam	30	40	12	17	30	40	15	1
Darroch loam	45	60	15	20	42	52	18	2
Darroch silt loam	45	60	17	22	45	55	20	2
Deardruff fine sandy loam	30	40	12	15	30	38	15	2
Della silty clay loam	35	45	12	15	22	32	17	2
Dillon fine sandy loam	15	22	7	13	15	25	11	1
Dillon loamy fine sand	12	17	6	11	12	20	9	1
Edwards loamy muck	45	50	12	16	25	40	15	2
Edwards muck	40	45	11	15	22	35	12	2
Burned phase								
Foresman fine sandy loam	30	40	12	17	32	40	15	2
Foresman loam	42	55	17	22	45	52	18	2
Foresman silt loam	42	55	17	22	45	55	20	2
Granby fine sandy loam	35	42	12	16	25	35	15	2
Mucky subsoil phase	40	47	14	18	27	40	17	2
Granby loamy fine sand	22	30	10	14	17	20	11	1
Gravel and sand pits								
Griffin fine sandy loam	25	35	----	----	17	25	15	2
Griffin loam	35	45	----	----	20	30	18	2
Griffin loamy fine sand								
Hagener fine sandy loam, undulating phase	18	25	10	13	----	----	9	1
Hagener loamy fine sand:								
Undulating phase	15	20	8	10	----	----	----	-
Wind-eroded rolling phase								
Houghton loamy muck over sand	35	45	10	14	----	----	15	2
Houghton muck	50	60	12	16	25	35	15	2
Burned phase over sand								
Shallow phase over sand	35	45	10	14	----	----	14	1
Jasper fine sandy loam:								
Eroded sloping phase	30	35	10	12	25	32	12	1
Undulating phase	35	42	12	15	32	37	15	1
Jasper loam:								
Eroded sloping phase	32	40	12	15	35	40	13	1
Eroded undulating phase	35	42	14	17	38	45	15	2
Undulating phase	42	50	17	20	42	50	18	2

TABLE 7.—*Estimated average acre yields of principal crops on each soil of Newton C management*—Continued

Soil	Hybrid corn		Wheat		Oats		Soybeans	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu*
Jasper silt loam:	32	40	12	15	35	42	14	18
Eroded sloping phase	35	45	14	18	40	47	16	20
Eroded undulating phase	42	50	17	22	45	55	20	25
Undulating phase	40	50	16	20	40	50	20	25
Julian silty clay loam	45	55	18	22	40	50	22	28
Kaskaskia silt loam	37	45	18	22	35	42	15	20
Kibbie loam	37	45	18	22	37	45	15	20
Kibbie silt loam	40	47	12	15	20	27	12	15
Maumee fine sandy loam	40	47	12	15	20	27	12	15
Ferruginous phase	45	55	13	16	20	27	13	16
Mucky subsoil phase	45	55	14	17	25	35	15	20
Maumee loam	30	37	10	12	15	20	10	12
Maumee loamy fine sand								
Miami silt loam:	32	37	13	17	30	37	13	17
Eroded sloping phase	35	42	14	18	35	45	15	20
Eroded undulating phase								
Moderately steep phase	40	50	16	22	40	50	17	22
Undulating phase	20	30	8	12	17	28	12	15
Morocco fine sandy loam	17	27	6	10	14	20	9	13
Morocco loamy fine sand	15	20	7	10	15	22	9	13
Newton fine sandy loam	10	15	6	9	13	20	8	12
Newton loamy fine sand	48	57	15	20	42	52	18	23
Odell loam	50	60	17	22	45	55	20	25
Odell silt loam	35	42	12	15	27	32	12	15
Parr fine sandy loam, undulating phase								

Parr loam:								
Eroded sloping phase	35	40	13	16	30	37	13	1
Eroded undulating phase	37	42	15	18	37	42	15	2
Severely eroded undulating phase	30	35	10	13	25	32	10	1
Undulating phase	40	47	17	22	42	52	20	2
Parr silt loam:								
Eroded moderately steep phase	30	35	10	13	20	27	9	1
Eroded sloping phase	35	42	13	16	35	40	13	1
Eroded undulating phase	37	45	15	18	40	47	15	2
Undulating phase	42	50	17	22	45	55	20	2
Plainfield fine sand:								
Rolling phase	----	----	----	----	----	----	----	--
Severely wind-eroded rolling phase	----	----	----	----	----	----	----	--
Severely wind-eroded undulating phase	----	----	----	----	----	----	----	--
Undulating phase	10	16	6	9	----	----	6	
Wind-eroded rolling phase	----	----	----	----	----	----	----	--
Wind-eroded undulating phase	----	----	4	7	----	----	5	
Rensselaer loam	45	60	22	30	42	57	22	2
Rensselaer silt loam	50	65	22	30	45	60	25	3
Rensselaer silty clay loam	50	65	22	30	45	60	25	3
Stockwell loam:								
Eroded sloping phase	32	40	13	16	30	35	13	1
Undulating phase	40	45	16	20	35	42	17	2
Strole loam	40	50	17	22	42	52	18	2
Strole silt loam	42	52	15	20	40	50	16	2
Swygert loam	42	52	17	22	42	52	20	2
Swygert silt loam	40	47	15	20	40	50	17	2
Tippecanoe loam	42	47	17	22	37	45	17	2
Tuscola loam, undulating phase	40	45	15	20	35	42	15	1
Tuscola silt loam:								
Eroded undulating phase	37	42	13	17	30	37	13	1
Moderately steep phase	----	----	10	12	----	----	----	--
Wabash silt loam	50	60	12	15	35	45	20	2
Wabash silty clay loam	45	55	12	15	35	45	20	2
Weiss fine sand	----	----	----	----	----	----	----	--
Wind-eroded phase	----	----	----	----	----	----	----	--
Wooten fine sand	----	----	----	----	----	----	----	--
Wind-eroded phase	----	----	----	----	----	----	----	--

TABLE 8.—*Productivity ratings of the soils of Newton Count*

[Indexes in columns A refer to yields obtained under prevailing practices, which include crop rotat of some legumes, commercial fertilizer, lime, and barnyard and green manures; those in columns B methods of management, including more intensive use of the prevailing practices. Blank spaces grown or is not adapted]

Soil	Crop productivity i							
	Corn (100=50 bu.)		Wheat (100=25 bu.)		Oats (100=50 bu.)		Soybeans (100=25 bu.)	
	A	B	A	B	A	B	A	B
Chalmers silt loam	100	130	90	120	90	120	100	13
Chalmers silty clay loam	100	130	90	120	90	120	100	13
Rensselaer silt loam	100	130	90	120	90	120	100	13
Rensselaer silty clay loam	100	130	90	120	90	120	100	13
Odell silt loam	100	120	70	90	90	100	80	10
Houghton muck	100	120	50	65	50	70	60	9
Wabash silt loam	100	120	50	60	70	90	80	10
Odell loam	95	115	60	80	85	105	70	9
Chalmers loam	90	120	90	120	90	120	100	13
Rensselaer loam	90	120	90	120	85	115	90	11
Clyde silty clay loam	90	120	55	65	45	65	75	9
Darroch silt loam	90	120	70	90	90	110	80	10
Darroch loam	90	120	60	80	85	105	70	9
Edwards loamy muck	90	100	50	65	50	80	60	9
Maumee fine sandy loam, mucky subsoil phase	90	110	55	65	40	55	55	6
Maumee loam	90	110	55	70	50	70	60	8
Wabash silty clay loam	90	110	50	60	70	90	80	10

Kaskaskia silt loam	90	110	70	90	80	100	90	10
Foresman loam	85	110	70	90	90	105	70	9
Foresman silt loam	85	110	70	90	90	110	80	10
Jasper loam, undulating phase	85	100	70	80	85	100	70	9
Jasper silt loam, undulating phase	85	100	70	90	90	110	80	10
Parr silt loam, undulating phase	85	100	70	90	90	110	80	10
Parr loam, undulating phase	85	100	70	90	85	105	80	10
Swygert loam	85	105	70	90	85	105	80	10
Strole silt loam	85	105	60	80	80	100	65	8
Tippecanoe loam	85	95	70	90	75	90	70	8
Clarence loam	85	95	60	70	80	95	75	9
Edwards muck	80	90	45	60	45	70	50	8
Corwin loam	80	110	70	90	90	110	80	10
Corwin silt loam	80	110	70	90	90	110	80	10
Strole loam	80	100	70	90	85	105	70	9
Julian silty clay loam	80	100	65	80	80	100	80	9
Crosby silt loam	80	110	60	80	70	90	70	9
Miami silt loam, undulating phase	80	100	65	90	80	100	70	9
Maumee fine sandy loam	80	95	50	60	40	55	50	6
Ferruginous phase	80	95	50	60	40	55	50	6
Swygert silt loam	80	95	60	80	80	100	70	9
Granby fine sandy loam, mucky subsoil phase	80	95	55	70	55	80	70	9
Tuscola loam, undulating phase	80	90	60	80	70	85	60	7
Stockwell loam, undulating phase	80	90	65	80	70	85	70	8
Clarence silt loam	80	90	55	70	80	95	75	9
Parr silt loam, eroded undulating phase	75	90	60	70	80	95	60	8
Kibbie loam	75	90	70	90	70	85	60	8
Kibbie silt loam	75	90	70	90	75	90	60	8
Parr loam, eroded undulating phase	75	85	60	70	75	85	60	8
Tuscola silt loam, eroded undulating phase	75	85	55	70	60	75	55	7
Houghton muck, shallow phase over sand	70	90	40	55	-----	-----	55	7
Houghton loamy muck over sand	70	90	40	55	-----	-----	60	8
Della silty clay loam	70	90	50	60	45	65	70	9
Jasper silt loam, eroded undulating phase	70	90	55	70	80	95	65	8
Griffin loam	70	90	-----	-----	40	60	70	9
Jasper loam, eroded undulating phase	70	85	55	70	75	90	60	8
Miami silt loam, eroded undulating phase	70	85	55	70	70	90	60	8
Parr fine sandy loam, undulating phase	70	85	50	60	55	65	50	6
Jasper fine sandy loam, undulating phase	70	85	50	60	65	75	60	7

See footnote at end of table.

TABLE 8.—*Productivity ratings of the soils of Newton County, Ind*

Soil	Crop productivity i							
	Corn (100=50 bu.)		Wheat (100=25 bu.)		Oats (100=50 bu.)		Soybean (100=2 bu.)	
	A	B	A	B	A	B	A	B
Granby fine sandy loam	70	85	50	65	50	70	60	8
Parr silt loam, eroded sloping phase	70	85	55	65	70	80	55	6
Parr loam, eroded sloping phase	70	80	55	65	60	75	55	6
Jasper silt loam, eroded sloping phase	65	80	50	60	70	85	55	7
Jasper loam, eroded sloping phase	65	80	50	60	70	80	55	7
Stockwell loam, eroded sloping phase	65	80	55	65	60	70	55	6
Miami silt loam, eroded sloping phase	65	75	55	70	60	75	55	7
Darroch fine sandy loam	60	80	50	70	60	80	60	7
Deardurff fine sandy loam	60	80	50	60	60	75	60	8
Ayr fine sandy loam, undulating phase	60	80	50	70	60	75	60	8
Foresman fine sandy loam	60	80	50	70	65	80	60	8
Parr loam, severely eroded undulating phase	60	70	40	55	50	65	40	5
Jasper fine sandy loam, eroded sloping phase	60	70	40	55	50	65	50	5
Maumee loamy fine sand	60	75	40	50	30	40	40	5
Parr silt loam, eroded moderately steep phase	60	70	40	55	40	55	35	5
Griffin fine sandy loam	50	70			35	50	60	8
Ayr fine sandy loam, eroded undulating phase	50	55	35	55	40	50	40	5
Granby loamy fine sand	45	60	40	55	35	40	45	6
Ade fine sandy loam, undulating phase	40	60	35	55	45	55	30	5
Morocco fine sandy loam	40	60	30	50	35	55	50	6
Hagener fine sandy loam, undulating phase	35	50	40	55			35	5
Ade loamy fine sand, undulating phase	35	55	30	45	35	45	30	4
Morocco loamy fine sand	35	55	25	40	30	40	35	5

Coloma loamy fine sand, undulating phase	30	40	30	45	20	30	25	4
Berrien loamy fine sand	30	50	25	40	-----	-----	25	4
Dillon fine sandy loam	30	45	30	55	30	50	45	6
Newton fine sandy loam	30	40	30	40	30	45	35	5
Hagener loamy fine sand, undulating phase	30	40	30	40	-----	-----	-----	---
Dillon loamy fine sand	25	35	25	45	25	40	35	5
Coloma loamy fine sand, wind-eroded undulating phase	20	30	25	35	-----	-----	20	3
Newton loamy fine sand	20	30	25	35	25	40	30	5
Berrien loamy fine sand, wind-eroded phase	20	40	15	30	-----	-----	15	3
Alida loamy fine sand	20	30	25	35	-----	-----	30	4
Plainfield fine sand:								
Undulating phase	20	30	25	35	-----	-----	25	3
Wind-eroded undulating phase	-----	-----	15	30	-----	-----	20	3
Hagener loamy fine sand, wind-eroded rolling phase	-----	-----	-----	-----	-----	-----	-----	---
Berrien loamy fine sand, severely wind-eroded phase	-----	-----	-----	-----	-----	-----	-----	---
Miami silt loam, moderately steep phase	-----	-----	-----	-----	-----	-----	-----	---
Tuscola silt loam, moderately steep phase	-----	-----	40	50	-----	-----	-----	---
Plainfield fine sand:								
Rolling phase	-----	-----	-----	-----	-----	-----	-----	---
Severely wind-eroded rolling phase	-----	-----	-----	-----	-----	-----	-----	---
Severely wind-eroded undulating phase	-----	-----	-----	-----	-----	-----	-----	---
Wind-eroded rolling phase	-----	-----	-----	-----	-----	-----	-----	---
Griffin loamy fine sand	-----	-----	-----	-----	-----	-----	-----	---
Conrad fine sand	-----	-----	-----	-----	-----	-----	-----	---
Edwards muck, burned phase	-----	-----	-----	-----	-----	-----	-----	---
Houghton muck, burned phase over sand	-----	-----	-----	-----	-----	-----	-----	---
Weiss fine sand	-----	-----	-----	-----	-----	-----	-----	---
Wind-eroded phase	-----	-----	-----	-----	-----	-----	-----	---
Wooten fine sand	-----	-----	-----	-----	-----	-----	-----	---
Wind-eroded phase	-----	-----	-----	-----	-----	-----	-----	---
Bridgman sand, wind-eroded undulating phase	-----	-----	-----	-----	-----	-----	-----	---
Gravel and sand pits	-----	-----	-----	-----	-----	-----	-----	---

[1] Indexes indicate the approximate average production of each crop in percentage of the stand
sents the average yield obtained without the use of fertilizers on the more extensive and better so
in which the crop is most widely grown.

The rating compares the productivity of each soil for each crop to a standard of 100. The standard index represents the approximate average acre yield obtained without the use of amendments on the more extensive and better soil types of the regions of the United States in which the crop is most widely grown. An index of 50 indicates that the soil is about half as productive for the specified crop as the soil with the standard index. The standard yield for each crop is given at the head of each respective column. Soils given amendments, as lime and commercial fertilizer, or special practices and unusually productive soils may have productivity indexes of more than 100 for some crops.

MANAGEMENT OF THE SOILS [58a]

By A. T. WIANCKO, Department of Agronomy, Purdue University Agricultural Experiment Station

Successful agriculture depends upon a productive soil. Every farmer knows that soils differ in natural productivity, and his particular farm may have good soil, poor soil, or some of each. Unless he is prepared to move, the farmer must work with the soil he has, and to make the most of this soil he should understand its characteristics and learn to correct its deficiencies. This is not difficult because the individual farm has only two or three or, at the most, four or five different kinds of soil. Each of these soils may present different problems in treatment and general management, and these problems must be studied and understood in order that crops may be produced in the most satisfactory and profitable way.

The purpose of the following discussion is to call attention to the deficiencies of the several soils of the county and to outline the treatments most needed to yield satisfactory results. No system of soil management can be satisfactory unless in the long run it not only produces profitable returns but also maintains the productivity of the soil. Some soil treatments and methods of management may be profitable for a time but ruinous in the end. One-sided or unbalanced and inadequate soil treatments have been altogether too common in the history of farming in the United States. Many soils have been seriously injured; but many, on the other hand, have been improved. If present-day knowledge is applied, all soils that can be farmed at all can be improved and made profitably productive year after year by using properly balanced systems of treatment and employing methods of crop management that will continue to yield the farmer a satisfactory income.

In considering the management of the soils some idea of the plant nutrients they contain is first desirable. The approximate total of nitrogen, phosphorus, and potassium—expressed in pounds per acre of elements in the surface soil to a depth of 6 to 7 inches—and the relative quantities of available phosphorus and potassium are given for the principal soils of the county in table 9.

The total content of nitrogen generally indicates a soil's need for nitrogen and also the need for organic matter, because nitrogen and organic matter are closely associated in soils. Usually, the darker the soil the higher its content of both organic matter and nitrogen.

[58a] Rates of fertilizer application given in this section are those recommended in 1952.

TABLE 9.—*Approximate quantities of nitrogen, phosphorus, and potassium in certain soils of Newton County, Ind.*

[Elements in pounds per acre of surface soil, 6 to 7 inches deep]

Soil and map symbol	Total nitrogen	Acid soluble phosphorus[1]	Total potassium	Available phosphorus[2]	Available potassium[2]
	Pounds	*Pounds*	*Pounds*		
Ade fine sandy loam, undulating phase (AA)	5, 200	610	24, 000	L	L
Ade loamy fine sand, undulating phase (AB)	3, 000	800	24, 000	L	L
Alida loamy fine sand (AC)	4, 000	800	18, 000	L	L
Ayr fine sandy loam, undulating phase (AE)	5, 400	570	24, 000	L	L
Berrien loamy fine sand (BA)	1, 200	530	24, 000	L	L
Chalmers loam (CA)	9, 000	1, 100	26, 000	M	L
Chalmers silt loam (CB)	10, 400	1, 280	28, 000	M	L
Chalmers silty clay loam (CC)	10, 400	1, 430	30, 000	H	M
Clarence silt loam (CE)	7, 000	920	33, 000	L	M
Clyde silty clay loam (CF)	10, 200	1, 400	31, 000	H	H
Coloma loamy fine sand, undulating phase (CG)	1, 000	500	19, 000	L	L
Conrad fine sand (CK)	2, 400	530	16, 000	L	L
Corwin loam (CL)	4, 400	630	27, 000	L	L
Corwin silt loam (CM)	6, 000	810	28, 000	L	L
Crosby silt loam (CN)	2, 400	610	29, 000	L	M
Darroch fine sandy loam (DA)	5, 000	750	23, 000	L	L
Darroch loam (DB)	4, 400	780	28, 000	L	M
Darroch silt loam (DC)	4, 000	750	30. 000	L	M
Deardurff fine sandy loam (DD)	4, 800	550	25, 000	L	L
Della silty clay loam (DE)	10, 000	1, 330	30, 000	H	M
Dillon fine sandy loam (DF)	5, 600	630	18, 000	L	L
Dillon loamy fine sand (DG)	4, 600	590	19, 000	L	L
Edwards loamy muck (EA)	11, 700	680	13, 000	L	L
Edwards muck (EB)	28, 400	840	6, 000	L	L
Foresman fine sandy loam (FA)	3, 800	570	20, 000	L	L
Foresman loam (FB)	3, 900	840	24, 000	L	L
Foresman silt loam (FC)	3, 600	630	24, 000	L	L
Granby fine sandy loam (GA)	8, 000	790	19, 000	L	L
Granby fine sandy loam, mucky subsoil phase (GB)	10, 800	610	20, 000	L	L
Granby loamy fine sand (GC)	8, 000	800	18, 000	L	L
Griffin fine sandy loam (GD)	4, 800	690	23, 000	L	L
Griffin loam (GE)	4, 600	660	26, 000	L	L
Griffin loamy fine sand (GF)	4, 200	630	19, 000	L	L
Hagener fine sandy loam, undulating phase (HA)	2, 800	490	27, 000	L	L
Hagener loamy fine sand, undulating phase (HB)	2, 200	470	22, 000	L	L
Houghton loamy muck over sand (HD)	18, 000	550	8, 000	L	L
Houghton muck (HE)	29, 600	830	4, 000	L	L
Houghton muck, shallow phase over sand (HG)	30, 000	820	3, 000	L	L
Jasper fine sandy loam, undulating phase (JB)	2, 800	590	27, 000	L	L
Jasper loam, undulating phase (JE)	3, 000	570	26, 000	L	L
Jasper silt loam, undulating phase (JH)	4, 000	630	28, 000	L	L
Julian silty clay loam (JK)	7, 000	960	33, 000	L	M
Kaskaskia silt loam (KA)	8, 200	1, 450	26, 000	H	H
Kibbie loam (KB)	2, 000	520	26, 000	L	L
Kibbie silt loam (KC)	2, 400	590	28, 000	L	L
Maumee fine sandy loam (MA)	6, 200	700	21, 000	L	L

See footnotes at end of table.

TABLE 9.—*Approximate quantities of nitrogen, phosphorous, and potassium in certain soils of Newton County, Ind.*—Continued

Soil and map symbol	Total nitrogen	Total phosphorus[1]	Total potassium	Available phosphorus[2]	Available potassium[2]
	Pounds	*Pounds*	*Pounds*		
Maumee loam (MD)	6, 000	780	25, 000	M	L
Maumee loamy fine sand (ME)	8, 400	750	22, 000	L	L
Miami silt loam, undulating phase (MK)	2, 400	700	32, 000	L	M
Morocco fine sandy loam (ML)	1, 600	570	17, 000	L	L
Morocco loamy fine sand (MM)	1, 400	650	20, 000	M	L
Newton fine sandy loam (NA)	4, 800	780	20, 000	L	L
Newton loamy fine sand (NB)	4, 600	700	21, 000	L	L
Odell loam (OA)	6, 400	1, 060	22, 000	L	L
Odell silt loam (OB)	7, 000	900	23, 000	L	L
Parr fine sandy loam, undulating phase (PA)	4, 000	670	26, 000	L	L
Parr loam, undulating phase (PE)	6, 000	880	28, 000	L	M
Parr silt loam, undulating phase (PK)	6, 000	700	30, 000	L	M
Plainfield fine sand, undulating phase (PO)	1, 400	370	18, 000	L	L
Rensselaer loam (RA)	8, 000	1, 210	24, 000	M	L
Rensselaer silt loam (RB)	6, 400	1, 060	28, 000	M	L
Rensselaer silty clay loam (RC)	7, 600	980	29, 000	M	M
Stockwell loam, undulating phase (SB)	5, 200	920	30, 000	M	M
Strole loam (SC)	7, 600	650	28, 000	L	L
Strole silt loam (SD)	8, 000	730	30, 000	L	L
Swygert loam (SE)	6, 000	620	26, 000	L	L
Swygert silt loam (SF)	5, 000	730	35, 000	L	M
Tippecanoe loam (TA)	6, 000	1, 060	28, 000	M	M
Wabash silt loam (WA)	7, 600	940	30, 000	M	M
Wabash silty clay loam (WB)	8, 800	1, 270	32, 000	M	M
Weiss fine sand (WC)	1, 200	310	20, 000	L	L
Wooten fine sand (WE)	1, 200	230	17, 000	L	L

[1] Soluble in strong hydrochloric acid (specific gravity 1.115).
[2] L=low, M=medium, H—high.

Soils low in total nitrogen content soon wear out, so far as that element is concerned, unless the supply is replenished by the growing and turning under of legumes, or by the use of nitrogenous fertilizer.

The quantity of total phosphorus in most soils is usually about the same as that shown by a determination with strong acid, and therefore a separate column for total phosphorous content has been omitted from table 9. The supply of total phosphorus is low in most Indiana soils, and phosphatic fertilizers are generally needed.

The total quantity of potassium in a soil seldom can be considered indicative of its need for potash fertilizer. Some Indiana soils having more than 30,000 pounds of total potassium per acre in the 6-inch surface layer contain so little of this element in available form that they fail to produce corn satisfactorily without addition of potash fertilizer. Sandy and muck soils more often need potash fertilizer than clay and loam soils. Poorly drained soils and those with an impervious subsoil usually need potash fertilizer more than well-aerated deep ones.

The available phosphorus and potassium determinations of table 9 were made by means of so-called quick tests and are expressed in letters indicating low, medium, and high relative quantities. In interpreting these it may usually be assumed that soils testing low in a given element will respond to fertilization with that element. If the soil tests medium, there may be doubt as to whether or not fertilization would pay. A soil testing high seems to be in no immediate need of applications of the plant nutrient concerned. Because the quick test is easily made, it is recommended that the soil or soils of each field of the farm be tested every few years. Testing should be done periodically, for the available supply of any particular element may change because of the cropping system followed, the quantities of crops removed, the manure returned, and the fertilizer added. Tissue tests of plants at critical periods in development will show the nutrient status of the crop and which plant food elements are lowest in supply and most need replenishing.

In considering what has been said about the total and available supplies of plant foods in the soils of this county, it should be recognized that there are many other factors that affect the crop-producing powers of soils. The chemical data given in table 9 are therefore not intended to be the sole guide in determining the needs of the soil. The depth of the soil, the character of the layers of its profile, and the previous treatment and management it has received are all factors of great importance and should be taken into consideration.

Consider, for example, the character of soil layers. Tests indicate that nitrogen and phosphorus are much less available in the subsurface soil and subsoil than they are in the surface soil. On the other hand, potash in the subsoil seems to be of relatively high availability. Crop growth depends largely on the quantity of available nutrients with which the plant roots may come in contact. If the soil is such that a crop can root deeply, it may be able to make good growth even if the surface soil has a relatively low nutrient analysis. If roots can penetrate to only a shallow depth, however, the crop may be injured by a lack of nutrients, particularly potash, even if it is grown on a soil of higher analysis. The better soils and those containing large quantities of the plant-nutrient elements will endure exhaustive cropping much longer than those of low nutrient content.

The nitrogen, phosphorus, and potassium contents of a soil are by no means the only chemical indications of high or low fertility. One of the most important factors in soil fertility is the degree of acidity. Very acid soils will not produce well, even though there is no lack of plant nutrients. Nitrogen, phosphorus, and potassium are of some value when added to acid soils but will produce their full effect only after such soils are limed.

The percentage of nitrogen, the acidity, and the estimated lime requirement of the principal soils of the county are shown in table 10.

The acidity of soils is expressed as the pH value, or the approximate hydrogen-ion concentration. Soil acidity is rated as follows: Below pH 4.5, extremely acid; 4.5 to 5.0, very strongly acid; 5.1 to 5.5, strongly acid; 5.6 to 6.0, medium acid; 6.1 to 6.5, slightly acid; 6.6 to 7.3, neutral; 7.4 to 8.0, mildly alkaline; 8.1 to 9.0, strongly alkaline; and 9.1 or higher, very strongly alkaline.

In table 10 pH values are given for the surface soil (0 to 6 inches), the subsurface soil (6 to 18 inches), and the subsoil (18 to 36 inches).

TABLE 10.—*Nitrogen, acidity, and lime requirement of certain soils of Newton County, Ind.*

Soil and map symbol	Depth	Nitrogen	pH	Average depth to neutral material	Limestone requirement per acre
	Inches	*Percent*		*Inches*	*Tons*
Ade fine sandy loam, undulating phase (AA)	0–6	0.26	5.5	80	2–3
	6–18	.24	5.3		
	18–36	.13	5.6		
Ade loamy fine sand, undulating phase (AB)	0–6	.15	5.7	[1] 80	2–3
	6–18	.14	5.6		
	18–36	.06	5.6		
Alida loamy fine sand (AC)	0–6	.20	5.2	[1] 90	3
	6–18	.18	5.1		
	18–36	.05	4.9		
Ayr fine sandy loam, undulating phase (AE)	0–6	.27	6.1	55	3
	6–18	.24	5.6		
	18–36	.06	5.2		
Berrien loamy fine sand (BA)	0–6	.06	5.5	[1] 75	3–4
	6–18	.04	4.5		
	18–36	.03	4.5		
Chalmers loam (CA)	0–6	.45	6.8	[1] 10	0
	6–18	.20	6.9		
	18–36	.06	7.0		
Chalmers silt loam (CB)	0–6	.52	6.3	[1] 11	0
	6–18	.30	6.5		
	18–36	.05	6.8		
Chalmers silty clay loam (CC)	0–6	.52	6.3	0	0
	6–18	.32	6.5		
	18–36	.07	6.7		
Clarence silt loam (CE)	0–6	.35	6.3	20	0–1
	6–18	.20	6.5		
	18–36	.07	7.4		
Clyde silty clay loam (CF)	0–6	.51	7.3	0	0
	6–18	.42	7.2		
	18–36	.06	7.5		
Coloma loamy fine sand, undulating phase (CG)	0–6	.05	5.8	65	1–2
	6–18	.04	5.6		
	18–36	.03	5.6		
Conrad fine sand (CK)	0–6	.12	6.6	0	0
	6–18	.06	7.4		
	18–36	.04	8.0		
Corwin loam (CL)	0–6	.22	5.8	28	1–2
	6–18	.10	5.6		
	18–36	.06	6.8		
Corwin silt loam (CM)	0–6	.30	6.0	28	1–2
	6–18	.20	5.7		
	18–36	.06	6.0		
Crosby silt loam (CN)	0–6	.12	6.3	25	1–2
	6–18	.04	5.9		
	18–36	.04	7.2		
Darroch fine sandy loam (DA)	0–6	.25	5.6	50	1–2
	6–18	.12	6.0		
	18–36	.04	6.3		
Darroch loam (DB)	0–6	.22	6.2	50	1–2
	6–18	.14	5.8		
	18–36	.09	5.6		
Darroch silt loam (DC)	0–6	.20	6.4	45	1–2
	6–18	.13	5.8		
	18–36	.07	5.5		

See footnote at end of table.

TABLE 10.—*Nitrogen, acidity, and lime requirement of certain soils of Newton County, Ind.*—Continued

Soil and map symbol	Depth	Nitrogen	pH	Average depth to neutral material	Limestone requirement per acre
	Inches	*Percent*		*Inches*	*Tons*
Deardurff fine sandy loam (DD)	0–6	0.24	6.4	60	1–2
	6–18	.10	5.8		
	18–36	.04	6.0		
Della silty clay loam (DE)	0–6	.50	6.8	0	0
	6–18	.21	7.1		
	18–36	.05	7.2		
Dillon fine sandy loam (DF)	0–6	.28	5.1	70	3
	6–18	.24	5.1		
	18–36	.18	5.2		
Dillon loamy fine sand (DG)	0–6	.23	5.0	70	3
	6–18	.20	5.1		
	18–36	.16	5.5		
Edwards loamy muck (EA)	0–6	.78	7.5	0	0
	6–18	.88	7.4		
	18–36	.82	7.6		
Edwards muck (EB)	0–6	2.84	7.4	0	0
	6–18	3.60	7.4		
	18–36	.36	8.1		
Foresman fine sandy loam (FA)	0–6	.19	5.8	54	2
	6–18	.18	5.6		
	18–36	.04	5.6		
Foresman loam (FB)	0–6	.19	6.1	52	2
	6–18	.17	5.6		
	18–36	.06	5.2		
Foresman silt loam (FC)	0–6	.18	6.0	50	2
	6–18	.17	5.6		
	18–36	.05	5.8		
Granby fine sandy loam (GA)	0–6	.40	6.4	18	0–1
	6–18	.18	6.2		
	18–36	.03	6.5		
Granby fine sandy loam, mucky subsoil phase (GB)	0–6	.54	6.2	0	0
	6–18	.44	6.4		
	18–36	.02	6.6		
Granby loamy fine sand (GC)	0–6	.40	6.3	18	0–1
	6–18	.27	6.4		
	18–36	.04	6.7		
Griffin fine sandy loam (GD)	0–6	.24	6.8	0	0
	6–18	.13	6.9		
	18–36	.08	7.0		
Griffin loam (GE)	0–6	.23	6.5	0	0
	6–18	.11	6.7		
	18–36	.07	6.9		
Griffin loamy fine sand (GF)	0–6	.21	6.6	0	0
	6–18	.14	7.1		
	18–36	.03	7.1		
Hagener fine sandy loam, undulating phase (HA)	0–6	.14	6.2	90	1–2
	6–18	.11	6.1		
	18–36	.08	5.7		
Hagener loamy fine sand, undulating phase (HB)	0–6	.08	6.1	110	1–2
	6–18	.07	6.0		
	18–36	.04	5.9		
Houghton loamy muck over sand (HD)	0–6	1.20	5.5	-------	0–2
	6–18	1.30	5.6		
	18–36	.21	5.8		

See footnote at end of table.

TABLE 10.—*Nitrogen, acidity, and lime requirement of certain soils of Newton County, Ind.*—Continued

Soil and map symbol	Depth	Nitrogen	pH	Average depth to neutral material	Limestone requirement per acre
	Inches	*Percent*		*Inches*	*Tons*
Houghton muck (HE)	0–6	2.96	6.1	-------	0–2
	6–18	2.58	5.8		
	18–36	2.30	5.6		
Houghton muck, shallow phase over sand (HG).	0–6	3.00	5.4	-------	0–2
	6–18	2.86	5.6		
	18–36	1.08	5.9		
Jasper fine sandy loam, undulating phase (JB).	0–6	.14	6.0	50	2
	6–18	.08	5.9		
	18–36	.02	5.6		
Jasper loam, undulating phase (JE)	0–6	.15	6.0	45	2
	6–18	.09	5.4		
	18–36	.05	5.4		
Jasper silt loam, undulating phase (JH).	0–6	.20	6.1	45	2
	6–18	.09	5.8		
	18–36	.05	5.5		
Julian silty clay loam (JK)	0–6	.35	6.6	0	0
	6–18	.11	7.0		
	18–36	.06	8.1		
Kaskaskia silt loam (KA)	0–6	.41	6.2	20	0–1
	6–18	.40	6.4		
	18–36	.36	6.6		
Kibbie loam (KB)	0–6	.10	6.0	45	1.2
	6–18	.06	5.7		
	18–36	.04	5.7		
Kibbie silt loam (KC)	0–6	.12	6.1	45	1–2
	6–18	.10	5.8		
	18–36	.08	5.8		
Maumee fine sandy loam (MA)	0–6	.31	6.6	0	0
	6–18	.20	6.4		
	18–36	.14	6.8		
Maumee loam (MD)	0–6	.30	6.7	0	0
	6–18	.28	6.4		
	18–36	.16	6.9		
Maumee loamy fine sand (ME)	0–6	.42	6.7	0	0
	6–18	.30	6.5		
	18–36	.10	6.9		
Miami silt loam, undulating phase (MK).	0–6	.12	6.1	25	1–2
	6–18	.08	5.7		
	18–36	.04	6.4		
Morocco fine sandy loam (ML)	0–6	.08	5.2	[1] 80	3–4
	6–18	.04	5.0		
	18–36	.03	5.0		
Morocco loamy fine sand (MM)	0–6	.07	5.0	[1] 80	3–4
	6–18	.04	4.8		
	18–36	.03	4.5		
Newton fine sandy loam (NA)	0–6	.24	4.8	[1] 80	3–4
	6–18	.18	4.5		
	18–36	.08	5.0		
Newton loamy fine sand (NB)	0–6	.23	4.7	80	3–4
	6–18	.16	4.5		
	18–36	.04	4.8		
Odell loam (OA)	0–6	.32	6.1	28	1–2
	6–18	.22	5.9		
	18–36	.06	6.8		

See footnote at end of table.

TABLE 10.—*Nitrogen, acidity, and lime requirement of certain soils of Newton County, Ind.*—Continued

Soil and map symbol	Depth	Nitrogen	pH	Average depth to neutral material	Limestone requirement per acre
	Inches	*Percent*		*Inches*	*Tons*
Odell silt loam (OB)	0–6	0.35	6.1	28	1–2
	6–18	.28	6.0		
	18–36	.07	6.6		
Parr fine sandy loam, undulating phase (PA)	0–6	.20	5.7	35	1–2
	6–18	.15	5.9		
	8–36	.06	6.1		
Parr loam, undulating phase (PE)	0–6	.30	5.8	35	1–2
	6–18	.20	5.8		
	18–36	.06	6.0		
Parr silt loam, undulating phase (PK)	0–6	.30	6.0	32	1–2
	6–18	.26	5.8		
	18–36	.07	6.2		
Plainfield fine sand, undulating phase (Po).	0–6	.07	5.5	80	3–4
	6–18	.05	5.4		
	18–36	.03	5.4		
Rensselaer loam (RA)	0–6	.40	6.5	0	0
	6–18	.32	6.6		
	18–36	.04	7.0		
Rensselaer silt loam (RB)	0–6	.32	6.5	0	0
	6–18	.30	6.5		
	18–36	.06	6.9		
Rensselaer silty clay loam (RC)	0–6	.38	6.6	0	0
	6–18	.32	6.7		
	18–36	.08	7.1		
Stockwell loam, undulating phase (SB).	0–6	.26	6.0	48	1–2
	6–18	.20	5.8		
	18–36	.05	5.9		
Strole loam (SC)	0–6	.38	6.5	15	0–1
	6–18	.18	6.6		
	18–36	.09	6.8		
Strole silt loam (SD)	0–6	.40	6.6	25	0–1
	6–18	.20	6.6		
	18–36	.09	7.0		
Swygert loam (SE)	0–6	.30	6.0	25	1
	6–18	.28	6.2		
	18–36	.08	6.4		
Swygert silt loam (SF)	0–6	.25	6.1	20	1
	6–18	.20	6.2		
	18–36	.06	6.5		
Tippecanoe loam (TA)	0–6	.30	5.8	48	2–3
	6–18	.18	5.6		
	18–36	.09	5.5		
Wabash silt loam (WA)	0–6	.38	6.8	0	0
	6–18	.32	6.9		
	18–36	.20	7.0		
Wabash silty clay loam (WB)	0–6	.44	6.7	0	0
	6–18	.40	6.7		
	18–36	.36	7.0		
Weiss fine sand (WC)	0–6	.06	6.8	0	0
	6–18	.03	7.4		
	18–36	.02	8.0		
Wooten fine sand (WE)	0–6	.06	6.0	50	1–2
	6–18	.03	5.8		
	18–36	.14	6.2		

[1] Acid to depth indicated.

The data are presented in this way because it is important to know the reaction of not only the surface soil but also of the lower layers. Given two soils of the same acidity of the surface layers, the one having the more acid subsurface layer is in greater need of lime. The thinner the layer of acid material, the lower the lime requirement Given the same degree of acidity, soils having the greater clay content will need a larger quantity of lime to neutralize them. Sweetclover, alfalfa, and red clover need more lime than other crops. As it is advisable to grow these better soil-improving legumes in the crop rotation, soils that are acid should be limed.

In interpreting the soil survey map and the soil analyses in tables 9 and 10, it should be borne in mind that a well-farmed and well-fertilized soil naturally low in fertility may produce larger crops than a poorly farmed soil naturally higher in fertility.

For convenience in discussing management, the soils of the county are arranged in groups according to important characteristics that indicate their need for similar treatment. For example, light-colored loams and silt loams of the uplands and terraces similar in soil treatment and crop management requirements may be conveniently discussed as a group, and the repetition that would be necessary if each soil were discussed separately is thereby eliminated. Where different treatments are required for a soil, they are specifically pointed out. Management of the various groups of soils is discussed in the following pages. The reader should study the group of soils in which he is particularly interested.

DARK LOAM, SILT LOAM, AND SILTY CLAY LOAM SOILS OF UPLANDS AND TERRACES

The dark loam, silt loam, and silty clay loam soils of the uplands and terraces are Chalmers loam, silt loam, and silty clay loam; Clarence loam and silt loam; Clyde silty clay loam; Corwin loam and silt loam; Darroch loam and silt loam; Della silty clay loam; Foresman loam and silt loam; the eroded sloping, eroded undulating, and undulating phases of Jasper loam and Jasper silt loam; Julian silty clay loam; Maumee loam; Odell loam and silt loam; the eroded sloping, eroded undulating, severely eroded undulating, and undulating phases of Parr loam; the eroded moderately steep, eroded sloping, eroded undulating, and undulating phases of Parr silt loam; Rensselaer loam, silt loam, and silty clay loam; the eroded sloping and undulating phases of Stockwell loam; Strole loam and silt loam; Swygert loam and silt loam; and Tippecanoe loam. Together, these soils occupy 124,185 acres, or 46.9 percent of the county. As a group, they are the best soils in the county.

DRAINAGE

The Jasper, Stockwell, and Parr soils are naturally well drained; the Corwin, Darroch, Foresman, Strole, Tippecanoe, Clarence, Odell, and Swygert have imperfect to moderate natural drainage; and the rest of the soils of the group have very poor natural drainage. Much artificial drainage has been provided by means of tile and open ditches, but better drainage facilities are needed in many places.

Tile underdrainage is usually most satisfactory where proper outlets can be procured. In some places, open ditches may be needed. Tile lines should be laid 30 to 40 inches deep and spaced 3 to 4 rods

apart. In very heavy or tight subsoil it may be best to space the tile lines somewhat closer, for without good drainage to a reasonable depth, the low-lying heavy soils of this group cannot be cropped satisfactorily and no other beneficial soil treatment can produce its full effect. Good drainage facilitates soil aeration and thereby permits the deeper penetration of oxygen that helps to make plant nutrients in the soil more available. Proper drainage also permits development of stronger and more efficient root systems through which plants absorb the nutrients they require for best development. Heavy fertilization may be of no avail if healthy root growth is hindered by excess water that shuts out needed oxygen.

Where the land to be tiled is level or nearly level, great care must be exercised in laying the tile lines so they will have an even or accelerated fall. Nothing less accurate than a surveyor's instrument should be used in establishing grades, and the grade stakes on the individual lines should be carefully set and checked before the ditches are dug to make sure that the water will flow to the outlet without interruption or slackening of the current. Checking the current is likely to cause the tile to become choked with silt. The rate of fall may be increased toward the outlet of the line but should never be decreased unless a silt well or settling basin is inserted. The silt well should have an inside area of at least a square foot and should extend a foot below the bottom of the tile line that empties into it. If the silt well is constructed in this way, any fine soil material carried into the tile by the current can be dropped. The silt well should have a removable cover to facilitate periodic emptying. Where open ditches are used for drainage, care should be taken not to lower the water table too much in soils having sand or gravelly substrata at shallow depths.

EROSION CONTROL

Some cultivated areas of the Jasper, Parr, and Stockwell soils present problems in erosion control that should receive attention. In places, much or all of the surface soil has been washed away. Such eroded areas should be taken out of cultivation or protected by some effective means of erosion control. Wherever practicable, plowing and tillage operations should extend crosswise of the slopes to prevent the formation of watercourses. Watercourses down the slopes are certain to carry away valuable surface soil and may produce serious gullies. Incipient gullies or draws forming natural waterways down the slopes should be kept permanently in grass. A good sod cover wide enough across to allow spreading of the water is required to prevent soil cutting in waterways.

LIME REQUIREMENTS

The Chalmers, Clyde, Della, Julian, and Rensselaer soils show little or no need for lime. Some areas of the Clarence, Maumee, and Strole soils may respond to light liming. The Corwin, Darroch, Foresman, Odell, Parr, Stockwell, and Swygert soils show a lime requirement of 1 to 2 tons an acre of ground limestone, or its equivalent in some other form of lime. Samples of the Jasper soils indicate a lime requirement of 2 tons an acre, and those of Tippecanoe loam, 2 to 3 tons an acre. Where there is doubt about the lime requirement of any of these soils, acidity tests should be made. If the farmer is unable to make the test himself, it is suggested that he send his soil samples to

the State soil testing laboratory at Purdue University Agricultural Experiment Station. They will run tests for certain available plant nutrients and pH and lime requirements and make fertilizer recommendations on the basis of the tests. In 1952 the charges were 50 cents per sample or a minimum charge of $1.00.

ORGANIC MATTER AND NITROGEN

The Chalmers, Clarence, Clyde, Della, Julian, Maumee, Odell, Rensselaer, Darroch, Foresman, and Strole soils are well supplied with organic matter and nitrogen, and with reasonable care in their management, no special provision for supplying these constituents will be necessary for a long time. Nonetheless, as a general rule, it will be advisable to include a little quickly available nitrogen in the fertilizer when small grains and vegetables are grown. The Corwin, Jasper, Parr, Stockwell, Swygert, and Tippecanoe soils have slightly less organic matter and nitrogen and, if it can be prevented, should not be allowed to become lower in these constituents. All available manure should be applied; cornstalks, straw, and such crop residues should be incorporated in the soil; and sod-forming legumes should be included in the crop rotation.

CROP ROTATION

After proper attention to drainage and the application of lime where needed, the soils of this group will produce all the ordinary crops adapted to the area, but these crops should be rotated. In general farming that includes the feeding of cattle, the following are among the crop rotations satisfactorily employed: (1) Corn, oats or wheat, and mixed hay; (2) corn, corn, oats or wheat, and mixed hay; (3) corn, soybeans, oats or wheat, and mixed hay; and (4) corn, corn, soybeans, oats or wheat, and mixed hay.

A mixed seeding for the hay crop is gaining favor over the seedings of clover alone or of clover and timothy commonly used in the past. A mixed seeding lessens the danger of getting an unsatisfactory stand. A good hay mixture for general use is made up of 3 pounds each of red clover and alfalfa, 2 pounds of alsike clover, 2 pounds of timothy, and ¼ pound of Ladino clover an acre.

A rotation of corn followed by oats seeded with sweetclover has become popular in some localities where corn and oats were formerly grown without the sweetclover. The sweetclover is plowed under as green manure for the benefit of the corn in the spring following the harvest of the oats. Among the straight grain-farming rotations suitable for farms not equipped for handling cattle are (1) corn, soybeans, and wheat or oats and (2) corn, soybeans, wheat or oats. In all the rotations the cornstalks and straw should be left on the land. As a further aid in maintaining organic and nitrogen supplies in the soils, seed winter rye in the standing corn early in September or seed sweetclover in the oats or wheat and then plow the green-manure crop under the following spring.

Where the European corn borer is a menace, small grains should not follow corn, because the cornstalks must be completely plowed under, and this is difficult to accomplish. A rotation in which soybeans intervene between the corn and small-grain crops will help solve the corn borer problem.

Alfalfa and sweetclover can be grown alone on the adequately drained soils of this group, and those soils will also produce good permanent bluegrass pasture. A half-and-half mixture of alfalfa and timothy makes good temporary pasture. On some farms it may be most satisfactory to let the hay sown in the regular crop rotation stand over another year and use it for pasture.

The better drained and more friable of these soils will produce good crops of various vegetables, but the advisability of this use depends on the availability of satisfactory markets and of the extra labor required to handle such crops.

FERTILIZATION

The soils of this group are fairly well to well supplied with nitrogen. The total quantity of phosphorus contained is larger than in the light-colored soils of similar texture but is not large enough to warrant drawing upon the store of this element to any considerable extent. For best results soils should be fertilized at rates which maintain the available phosphate (P_2O_5) at 200 pounds and the available potash (K_2O) at 250 pounds.

In the practical fertilization of the soils of this group, manure should be applied on the lighter colored soil areas. Where manure has been applied for corn, the usual fertilizer treatment should be 150 pounds an acre of 0–12–12, 0–20–10, or 0–10–20. The analysis used will depend upon the relative availability of phosphorus and potassium in the soil as shown by the quick tests. Fertilizer should be applied through a divided fertilizer attachment on the planter that will place some on both sides of the hill. If manure is not used, applications of fertilizer should be somewhat heavier, particularly on the less fertile soils. For such soils it may be most practical to plow under 400 to 600 pounds an acre of 8–8–8 or fertilizer of similar analysis and then apply 150 pounds of 3–12–12 through the fertilizer attachment on the corn planter.

If soybeans follow well-fertilized corn, as should be the general practice, they need not be specially fertilized, at least on the better soils. On the poorer soil areas not well fertilized previously, application of some phosphate and potash fertilizer, as a 0–10–20 mixture, at the rate of 300 to 400 pounds an acre, will usually be profitable. Plow under two-thirds of this quantity and apply one-third on both sides of the row at planting time by using a divided fertilizer attachment on the planter. Heavier applications in the row are not advisable because soybeans are susceptible to fertilizer injury during germination and early growth.

Small grains usually should receive a mixed fertilizer, which is drilled with the seed. Wheat particularly needs a complete fertilizer to encourage rapid fall growth. Such growth is important because it is advisable to sow wheat late to escape hessian fly infestation. The fertilizer for small grain should be high in phosphate and potash, and the application should be heavy enough to meet the needs of the hay crop to follow. For the heavier textured soils the 3–12–12 analysis may be best, but for the lighter textured ones, the 3–9–18 may be preferable. The rate of application should be about 300 pounds an acre. Where oats are likely to develop a rank growth of straw and lodge, as they tend to do on the more fertile soils high in nitrogen,

it may be best to omit nitrogen from the fertilizer and use 0–12–12 or 0–10–20.

Permanent pasture should be top-dressed occasionally with superphosphate or a mixture of phosphate and potash. Vegetables and other specialized crops that may be grown on these soils will require special fertilization. Specific recommendations for each crop can be procured from the Purdue University Agricultural Experiment Station at Lafayette.

LIGHT-COLORED LOAM AND SILT LOAM SOILS OF UPLANDS AND TERRACES

The light-colored loam and silt loam soils of uplands and terraces are Crosby silt loam; Kibbie loam; Kibbie silt loam; the eroded sloping, eroded undulating, moderately steep, and undulating phases of Miami silt loam; Tuscola loam, undulating phase; and the eroded undulating and moderately steep phases of Tuscola silt loam. Together, these soils occupy 3,230 acres, or 1.2 percent of the county, but the acreage suitable for cultivation is somewhat less, as areas of the more sloping and steeper phases of the Miami and Tuscola soils are essentially nonagricultural. Management for these nonagricultural areas is discussed under Nonarable Land.

DRAINAGE

The Miami and Tuscola soils have good natural drainage, but the Crosby and Kibbie need artificial drainage, and if they are to be farmed most satisfactorily should be underdrained by tile lines. Wherever there is a gray or grayish-mottled subsoil, insufficient drainage is indicated. Without tile underdrainage, no other beneficial soil treatment can produce its full effect. Tile drainage facilitates soil aeration, which permits the deeper penetration of oxygen that helps to make plant nutrients in the soil more available. Tile drainage also permits development of stronger and more efficient root systems through which plants absorb the nutrients they require for best growth. The results of liberal fertilization are certain to be disappointing if healthy root growth is hindered by excess water in the soil that shuts out needed oxygen.

Some areas already have been tiled, but where tiling is still needed, the lines should be laid 30 to 40 inches deep and spaced about 3 rods apart. The details of installing tile drainage for these soils will be much the same as decribed for the group of poorly drained dark loam, silt loam, and silty clay loam soils.

EROSION CONTROL

Some cultivated areas of the Miami and Tuscola soils present problems in erosion control that should receive attention. In places much or all of the surface soil has been washed away. Such eroded areas should be taken out of cultivation or be protected by some effective means of erosion control. In cultivated fields where slopes are subject to erosion, plowing and other tillage operations should extend crosswise of the slopes and the rotation should be one that keeps the land in small grain and hay crops much of the time. On some of these eroded areas, contour strip cropping may be practicable. Incipient gullies or draws forming natural waterways down the slopes

should be kept permanently in grass. There should be an area of tough sod wide enough across the gullies to allow the spreading of water so as to prevent further erosion. In some places erosive areas are large enough to form separate fields that can be fenced off and used for permanent pasture.

LIMING

All the soils of this group are slightly to medium acid and will respond to some liming. Usually, 1 or 2 tons an acre of ground limestone, or the equivalent in some other form of lime, applied every few years will be sufficient to neutralize harmful acidity. Where alfalfa or sweetclover is to be grown, somewhat heavier liming may be required for best results.

ORGANIC MATTER AND NITROGEN

All the soils of this group are naturally low in organic matter and nitrogen. The lighter the color of the soil, the lower the content of these important constituents. Constant cropping, without adequate returns of organic matter to the land, is steadily making matters worse. In some places, particularly on the finer textured soils, the original supplies of organic matter have become so reduced that the soil has lost much of its native mellowness and easily becomes puddled and baked. This condition largely accounts for the more frequent failure of clover and grass seedings and the greater difficulty of obtaining proper soil tilth in preparing the land for crops.

Wherever there is evidence of lack of organic matter, the only practical remedy is to plow under or otherwise incorporate into the soil more organic matter than is used up in cropping. Organic matter, necessary to the maintenance of soil fertility, is constantly decomposing, and the greater part of the nitrogen required by crops must be supplied by this decomposing organic matter. The organic matter and nitrogen must be replaced, and legumes—aside from their value as a source of organic matter—are the only crops that can add appreciable quantities of nitrogen to the soil through the action of nitrogen-gathering bacteria. Legumes therefore should be utilized as fully as practicable in the cropping system. Legume top growth should be returned to the soil either directly or in the form of manure. Wherever legume seeds are harvested, the straw, or haulm, should be returned to the land.

As much manure as possible should be made from the produce by feeding it to livestock, and all produce not so fed should be incorporated into the soil directly. Cornstalks left in the field should never be burned. Burning destroys both organic matter and nitrogen. A modern plow equipped with Purdue trash shields will turn down and completely cover cornstalks and other heavy growth. A good practice for increasing the organic matter and conserving nitrogen is the seeding of rye as a cover crop in August or early in September on cornland that is to be plowed the following spring.

Some kind of growing crop should be on the soils during fall and winter. Growing crops take up the soluble nitrogen that would otherwise be lost through leaching. Without living crop roots to take up the nitrates from the soil water, large losses are likely to occur in periods between the regular summer crop seasons, and there will also be more soil erosion on slopes and hillsides.

CROP ROTATIONS

With proper fertilization, drainage, and liming where needed, the soils of this group suitable for cultivation will satisfactorily produce all the ordinary crops of the area. Because of the prevailing shortage of nitrogen, every system of cropping should include clover or some other legume to be returned to the land in one form or another. The best short rotation for general use on these soils—provided the cornstalks can be properly disposed of in case the European corn borer is a menace—is corn, wheat or oats, and a hay crop of clover or of mixed clover, alfalfa, and timothy.

Corn, soybeans, wheat or oats, and mixed hay constitute an excellent 4-year rotation for these soils. This rotation also simplifies disposal of cornstalks infested with corn borers, as these can be completely turned under when plowing the land for the soybean crop. The two legumes in this rotation (soybeans and a legume in the hay mixture) will build up the nitrogen supply if a considerable part of the top growth is left on the ground or returned either directly or in the form of manure. With modern combine-harvesters, the soybean straw can be spread evenly on the ground and will not interfere with the seeding of wheat or oats. When soybeans are first planted, the seed should be carefully inoculated with the proper variety of nitrogen-gathering bacteria, and this inoculation should be applied at least 2 years in succession.

If more corn is wanted, as is desirable on intensive livestock farms, a 5-year rotation of corn, corn, soybeans, wheat or oats, and mixed hay may be used satisfactorily where the second corn crop, at least, can be given a good dressing of manure. If enough livestock is kept to utilize all the feed, grain, and roughage produced in the 5-year rotation, there should be enough manure to make a fair application to each crop of corn. In both the 4- and 5-year rotations, a winter cover crop of rye should be seeded in the corn in September and plowed under with the corn residues the following spring.

Occasionally, unfavorable weather causes an unsatisfactory stand of hay, and to guard against this in any of the suggested rotations, it is a good plan to sow a hay mixture made up of 3 or 4 pounds each of red clover and alfalfa, 2 pounds of alsike clover, ¼ pound of Ladino clover, and 2 pounds of timothy an acre. This seeding is also suitable for pasture and can be allowed to stand a second year if needed for that purpose.

Alfalfa and sweetclover can be grown alone on these soils if the land is drained and limed where needed and the crop is properly inoculated with its nitrogen-gathering bacteria. In locations favorable to alfalfa, a separate field of alfalfa has been found good insurance against a shortage of hay or pasture.

FERTILIZATION

The light-colored loam and silt loam soils of the uplands and terraces are naturally low in phosphorus. The available supply is so low that the quantity required by crops should be wholly supplied in applications of manure and commercial fertilizer. The nitrogen supply is also too low to meet satisfactorily the needs of corn, wheat, oats, and other nonleguminous crops, and provisions for adding nitrogen must be made in the soil-improvement and crop-fertilization program.

The total quantity of potassium in these soils is large, but in most of the cultivated acreage the supply available to plants has become so reduced that a considerable quantity of potash, contained in manure and commercial fertilizer, must be applied for the most satisfactory production of crops. Unless provision for supplying substantial quantities of nitrogen, phosphorus, and potassium is made, these soils will remain relatively low in productivity.

Legumes and manure are the logical materials for supplying the greater part of the nitrogen required by crops, and they should be employed to the fullest practicable extent for that purpose. These soils are best used in a system of livestock farming, and the crop rotation should be one that will permit keeping the land in legume crops a large part of the time.

The only practical way to increase the supply of phosphorus in the soils is to apply purchased phosphatic fertilizer to the crops, and because much of the phosphate applied is fixed by the soil in forms not immediately available, a quantity much larger than the crop actually needs should be used. Manure, of course, should be used to the fullest possible extent, but it must be remembered that manure returns to the soil only a part of the phosphorus and potassium taken out by the crops.

There would be no objection to drawing upon the large natural store of potassium in these soils if it could be made available at a faster rate. Usually, however, it becomes available too slowly. The availability of soil potassium may be increased by good farming practices, including drainage where needed, deep tillage, the growing of deep-rooted legumes, and the plowing under of large quantities of organic matter.

In the practical fertilization of these soils, so far as the ordinary field crops are concerned, most of the manure should be plowed under for the corn crop. Where the crop rotation includes wheat, some of the manure (about 2 tons an acre) may be applied profitably to this crop as a top dressing during winter. Manure so used not only helps the wheat and lessens winter injury but also aids in insuring a stand of clover or of a hay mixture, either of which may be sown in the wheat in spring. In addition to the manure plowed under, corn should receive 100 pounds an acre beside the hill, or 200 pounds in the row, of a phosphate and potash mixture at least as good as 0–12–12. Where little or no manure is applied and corn yields would be low without more fertilizing, it will pay to plow under from 500 to 800 pounds an acre of 8–8–8 fertilizer and also make a light application of 3–12–12 in the hill or row. Such applications have been profitable on medium to heavy light-colored soils in other parts of the State.

Wheat and oats should receive 300 to 400 pounds an acre of 3–12–12 or 3–9–18 fertilizer, regardless of their place in the rotation. Use the 3–9–18 analysis and heavier application if a hay mixture is to be seeded in the wheat in spring and if a large application of manure or fertilizer has not been made earlier in the crop rotation. In places where wheat is backward in spring, a top dressing of 30 pounds an acre of elemental nitrogen should be applied soon after growth begins. Such a top dressing may be expected to add several bushels an acre to the yield.

The fertilizer requirements of soybeans are best met by making extra heavy applications of phosphate and potash to the preceding corn crop. If this is not done, most of the fertilizer needed should be plowed under; only a small quantity should be applied with the seed at planting time because soybeans are very sensitive to fertilizer injury during germination and early growth. Either 0–12–12 or 0–10–20 fertilizer should be used for soybeans, and application should be at the rate of 300 to 400 pounds an acre. Plow under two-thirds of the fertilizer and place one-third on both sides of the row at seeding time by using a divided fertilizer attachment on the planter.

Alfalfa is well adapted to the better drained soils of this group and will prove profitable and dependable for either hay or pasture if the land is limed where needed and liberally fertilized with phosphate and potash. From 300 to 400 pounds an acre of 0–12–12 or similar fertilizer should be applied to alfalfa at seeding time. Alfalfa may be sown with a light seeding of oats in spring, or by itself on specially prepared ground some time in August after a good rain. To maintain good yields and prolong the life of the stand, a top dressing of 300 pounds an acre of 0–12–12 or 0–10–20 should be applied every spring.

Permanent pasture can be restored by light liming as needed, reseeding if the stand is thin, and application of fertilizer. Reseed with a legume mixture, including alfalfa and a little white and Ladino clover, and fertilize with 300 to 500 pounds an acre of superphosphate or 0–20–10 at the beginning of the treatment and again every 3 or 4 years.

For special crops that may be grown on these soils, special fertilization will be required. Specific fertilizer recommendations for the particular crop and soil condition can be obtained from the Purdue University Agricultural Experiment Station at Lafayette.

LIGHT-COLORED SANDY SOILS OF UPLANDS AND TERRACES

The light-colored sandy soils of the uplands and terraces are Berrien loamy fine sand and its severely wind-eroded and wind-eroded phases; Bridgman sand, wind-eroded undulating phase; the undulating and wind-eroded undulating phases of Coloma loamy fine sand; Morocco loamy fine sand and fine sandy loam; the rolling, severely wind-eroded rolling, severely wind-eroded undulating, undulating, wind-eroded rolling, and wind-eroded undulating phases of Plainfield fine sand; Weiss fine sand and its wind-eroded phase; and Wooten fine sand and its wind-eroded phase. Together these soils occupy 40,318 acres, or 15.3 percent of the county, but the acreage suitable for crops is less.

Much of the wind-eroded phases of Berrien loamy fine sand; practically all of Bridgman sand, wind-eroded undulating phase; the badly wind-eroded areas of Plainfield fine sand; and most of Wooten fine sand and its wind-eroded phase are so infertile and subject to wind erosion that they are unfit for cultivation. Soil areas not suited to cultivation are discussed in the section on Nonarable Land.

DRAINAGE

The light-colored sandy soils of uplands and terraces are so loose or open-textured that drainage is very rapid and droughtiness is serious. Some areas of the Berrien and Morocco soils that naturally had a high water table may need a little more drainage, but for the

most part dredge ditching has been overdone, and the soils are now droughty.

LIMING

All of these light-colored sandy soils except Weiss fine sand are acid and need liming. The Berrien, Morocco, and Plainfield soils are strongly acid and before other beneficial soil treatments can become fully effective usually require 3 to 4 tons an acre of ground limestone or its equivalent in other forms of lime. Heavy liming is particularly important where alfalfa is to be grown. The phases of Coloma loamy fine sand are medium in acidity but also require heavy liming for alfalfa. The quantity of lime needed on any particular field should be determined by soil acidity tests.

ORGANIC MATTER AND NITROGEN

The soils of this group are very low in organic matter, and more of this constituent is greatly needed to improve both their water-holding capacity and fertility. Droughtiness is one of their greatest weaknesses, but they are also very low in nitrogen. Liming and the application of mineral fertilizer should be first done to put these soils in a condition that will permit growing the more efficient nitrogen-gathering legumes. When this has been accomplished, legumes should be used to the fullest possible extent to provide the nitrogen needed by the other crops to be grown, as well as to supply large quantities of high-quality organic matter.

These sandy soils use up organic matter rapidly. Their loose excessively aerated condition favors rapid decomposition and oxidation, or the burning up, of the soil organic matter. For this reason, more than ordinary quantities of organic material, as manure, straw and other crop residues, specially grown green-manure crops, and cover crops, should be added constantly. The land should never be left without growing cover that will take up soluble plant nutrients, reduce losses through leaching, and prevent water and wind erosion. Wherever possible winter rye should be seeded in standing corn early in September so it may be plowed under with the cornstalks for soybeans the following spring.

CROP ROTATION

A good rotation of crops for general farming on these light-colored sandy soils is corn, soybeans, wheat, and alfalfa 2 or 3 years. This rotation is of course applicable only if thorough liming has been done so that alfalfa can be grown. In the more favorable places especially if there is a good alfalfa sod, two crops of corn can be grown in succession. As the small grain crop in the rotation, wheat is usually preferable to oats because it makes most of its growth before there is much dry weather and is therefore less liable to be injured by drought. Where oats are suited, as they are on some areas of the Berrien and Morocco soils having better moisture relations, an early variety should be used. On the more droughty soils, winter rye may do better than either wheat or oats. Where the land has not been put in condition to make alfalfa a dependable crop, a mixture of red clover, alfalfa, and timothy should be used as a 1-year hay crop.

Alfalfa will stand a lot of drought, and if sufficiently limed and fertilized with phosphate and potash, it will produce more than any other hay or pasture crop. On the sand experiment field on Plain-

field fine sand near Culver, in Marshall County, the most successful stands of alfalfa have been obtained from seedings made in July or early in August on disked small-grain stubble land. Some growers on these droughty soils favor late spring plowing and summer fallowing until late July or early August. They then lightly drill the alfalfa seed with some fertilizer on a well cultipacked surface. Extra phosphate and potash fertilizer should be deeply drilled in before the final preparation of the land for alfalfa seeding. A half-and-half mixture of alfalfa and bromegrass makes a good pasture mixture on these sandy soils.

Some of these sandy soils will produce high quality potatoes. When potatoes are grown on well-manured alfalfa sod and well fertilized, they are a good cash crop and may well be fitted into the cropping system in place of some of the corn. The well-drained sandy soils are also suited to melons, cucumbers, and berries of various kinds.

FERTILIZATION

The soils of this group are deficient in nitrogen, and legumes should be grown to supply as much nitrogen as possible for the nonleguminous crops. Manure should be utilized to the fullest possible extent, and all crop residues not otherwise utilized should go back to the land. However well these practices are followed, the grain crops will need some nitrogen in the commercial fertilizer used. It should be the rule to supply all the phosphorus needs of crops from outside sources because the natural supply of phosphorus in these sandy soils is so low that it should not be further drawn upon. Also, in determining the quantity of phosphatic fertilizer to apply, it should be remembered that a considerable part of the phosphorus applied is fixed by the soil in forms not immediately available to crops. Allowance for this should be made in the quantity applied.

The supply of available potassium is low in all these sandy soils, even though their total content of this element is high. The quantity of potash that must be applied depends upon the crop grown and its ability to obtain potash stored in the soil. The deep-rooted legumes have greater ability in this respect than do the cereals and the shallow-rooted legumes, as soybeans and lespedeza.

The fertilization program for these light-colored sandy soils must take into account their droughty and leachy nature, for these qualities limit the quantity of fertilizer that can be safely applied at one time. Manure is the safest fertilizer and as great a quantity as possible should be made and applied, especially for corn and small grains. Applying manure to small grains as a top dressing or disking it into the surface soil is favored.

Corn is not well suited to these soils and should never be expected to depend upon commercial fertilizer alone. The corn crop should have a legume sod to begin with, and this sod should be manured if possible. Then, if 100 to 150 pounds an acre of 0–12–12 or 0–10–20 fertilizer is placed on both sides of the hill when the corn is planted, a profitable yield can be expected.

The fertilizer needs of soybeans are best provided for by plowing under extra phosphate and potash for the preceding corn crop and then applying only a small quantity with the crop itself. About 100 to 150 pounds an acre of 0–10–20 or 0–9–27 should be applied at plant-

ing. Place this application on both sides of the row by using a divided fertilizer attachment on the planter because soybeans are very sensitive to fertilizer injury during germination and early growth. On land not previously well fertilized, about 200 pounds an acre of 0–10–20 or 0–9–27 fertilizer should be plowed under before planting soybeans.

The small-grain crop used in the rotation, preferably wheat, should receive 300 pounds an acre of 3–12–12 or 3–9–18 fertilizer, and this should be drilled with the seed. Wheat will generally respond to a top dressing of 30 pounds an acre of elemental nitrogen applied early in spring.

For alfalfa or alfalfa and bromegrass used for pasture, about 300 pounds an acre of 0–10–20 or 0–9–27 fertilizer should be applied at seeding time. Seeding usually should be after a rain late in July or early in August on deeply disked small-grain stubble land. To maintain good yields and prolong the life of the stand, a top dressing of 200 pounds an acre of the same fertilizer as that used at seeding should be applied every spring.

Grass pastures can be restored by light liming where necessary; reseeding with a legume mixture that includes alfalfa, Ladino clover, and lespedeza; and applying 200 to 300 pounds an acre of 0–12–12 or 0–10–20 fertilizer every 2 or 3 years.

For potatoes, melons, berries, and other horticultural crops, the fertilization is more specialized. Recommendations for the particular crop and soil condition should be obtained from the Department of Horticulture, Purdue University Agricultural Experiment Station, Lafayette.

DARK SANDY SOILS OF UPLANDS, TERRACES, AND OUTWASH PLAINS

The dark sandy soils of uplands, terraces, and outwash plains are Ade loamy fine sand, undulating phase; Ade fine sandy loam, undulating phase; Alida loamy fine sand; the eroded undulating and undulating phases of Ayr fine sandy loam; Conrad fine sand; Darroch fine sandy loam; Deardurff fine sandy loam; Dillon loamy fine sand and fine sandy loam; Foresman fine sandy loam; Granby fine sandy loam and its mucky subsoil phase; Granby loamy fine sand; the undulating and eroded sloping phases of Jasper fine sandy loam; Maumee loamy fine sand; Maumee fine sandy loam and its mucky subsoil and ferruginous phases; Newton loamy fine sand and fine sandy loam; Parr fine sandy loam, undulating phase; the undulating and wind-eroded rolling phases of Hagener loamy fine sand; and Hagener fine sandy loam, undulating phase.

These soils occupy a total area of 83,919 acres, or 31.8 percent of the county. Most of them are fairly well to well supplied with organic matter and nitrogen, at least in the surface soil. Conrad fine sand, both phases of Hagener loamy fine sand, both phases of Jasper fine sandy loam, and Hagener fine sandy loam, undulating phase, are not so well supplied with nitrogen and organic matter as the others, but they contain enough organic matter in the surface soil to warrant their inclusion with this dark sandy group of soils. The total quantity of phosphorus, as well as the quantity available for plants, is low in all instances. The total content of potassium is relatively high, but the quantity available for plants is low.

DRAINAGE

The Ade, Alida, Ayr, Deardurff, Foresman, Jasper, Parr, and Hagener soils have fair to excessive natural drainage. In most of them the water table is too low in dry seasons, and corn is often injured by lack of moisture in the latter part of summer. Darroch fine sandy loam usually needs a little artificial drainage. The Conrad, Dillon, Granby, Maumee, and Newton soils need artificial drainage because they were all developed in low-lying or depressional areas where the water table, especially in spring, is naturally too high for the satisfactory production of most crops.

Most areas have large open ditches to lower the general level of the water table and to permit more rapid drainage during periods of heavy rainfall. Where more drainage is needed, it can be provided by additional ditches or large tile spaced at relatively wide intervals, as water moves freely through these sandy soils if outlets are provided.

LIMING

The Conrad, Granby, and Maumee soils are normally neutral or only slightly acid and usually do not need liming. The Darroch, Deardurff, Foresman, Jasper, Parr, and Hagener soils are medium acid and usually require 1 to 2 tons an acre of ground limestone for grain crops. Where alfalfa or sweetclover is to be grown on the soils just mentioned, the liming should be somewhat heavier. The Ade, Alida, Dillon, and Newton soils are strongly to very strongly acid and should receive 3 to 4 tons an acre of ground limestone at the start. Then 1 or 2 tons an acre every 4 or 5 years may be required. Without liming, these very acid soils will not respond to any other beneficial soil treatment.

ORGANIC MATTER AND NITROGEN

The Conrad, Jasper, and Hagener soils are low in organic matter and nitrogen for intensive cropping, and constant attention should be given to the replenishing of their supply of these important constituents. Apply all of the manure that can be made from the crops grown and return to these soils all crop residues not used for feed or bedding. Sod-forming crops should be grown every 3 or 4 years. Crop residues should never be burned because burning destroys both the organic matter and nitrogen.

The other dark sandy soils of uplands, terraces, and outwash plains are fairly well to abundantly supplied with both organic matter and nitrogen, and with reasonable care in their management, including returning to the land all crop residues not otherwise utilized, these constituents can be maintained at a satisfactory level.

CROP ROTATION

On the higher lying soils of this group corn is likely to be injured by drought, and the crop rotation should therefore contain a relatively small percentage of corn and more hay than is grown on the lower lying soils with better moisture relations. A rotation of corn, soybeans, wheat or oats, and mixed hay is usually most practical.

As the small grain crop, wheat is preferable to oats because it makes most of its growth before droughty conditions develop. Deep-rooted and drought-resistant alfalfa should be more extensively grown for hay and pasture on the better drained areas. For this crop, the Ade,

Alida, and Ayr soils need heavy liming. The Deardurff, Foresman, Jasper, Parr, and Hagener soils are not so acid but need liming for the best growth of alfalfa. The Maumee and Granby soils need little or no liming and will grow alfalfa where sufficiently drained. The very strongly acid Newton and Dillon soils are most difficult to condition for alfalfa. Where alfalfa is grown for the first time, the seed should be carefully inoculated with the proper nitrogen-gathering bacteria.

On the lower lying soils of this group that have a higher organic content and better moisture relations, corn can be grown more frequently. A generally satisfactory rotation is corn, soybeans, oats, and mixed hay. On areas adequately drained, wheat may be grown in place of oats, provided the soybean harvest is not too late to allow seeding of the wheat. The Maumee soils are well suited to permanent bluegrass pasture and to the principal truck crops. The better drained soils of this group are suited to potatoes, melons, and various small fruits.

FERTILIZATION

The dark sandy soils are all deficient in available phosphorus and potassium. The total content of potassium is relatively high, but most of the supply is contained in unavailable forms. Because most crops require more potassium than phosphorous, potash should predominate in the fertilizer used. The supply of nitrogen is fair to abundant, and most crops will need little or no nitrogen in the fertilizer.

All the manure that can be made on the farm should be applied to the land, and generally it should be used for the corn crop. If the farm has both light-colored and dark soils, however, the manure should be applied to the lighter colored areas because they most need the organic matter and nitrogen the manure contains. Commercial fertilizer high in phosphate and potash can be depended on to a greater extent for the dark soils.

Because the soils of this group are open textured and leachy, it is generally best to fertilize each crop separately. On manured land, corn should receive 100 to 150 pounds an acre of 3–12–12 fertilizer placed on both sides of the hill through a divided fertilizer attachment on the corn planter. If the land is not manured, much more fertilizer will be needed. Provided drought does not interfere, results will be satisfactory on unmanured land if 300 pounds an acre of 0–12–20 or 0–9–27 is plowed under for corn and 150 pounds of 3–12–12 is applied with the planter. After the last cultivation, 30 pounds of elemental nitrogen may be applied as a side dressing.

Soybeans should follow corn in the crop rotation and should receive about 300 pounds an acre of 0–10–20 or 0–9–27. Plow under two-thirds of the quantity and apply one-third at seeding time through a fertilizer attachment on the planter. An attachment that places the fertilizer on both sides of the row and a little away from the seed should be used because soybeans are very sensitive to fertilizer injury during germination and early growth.

Oats grown on the darker sandy soils should be fertilized with 300 to 400 pounds an acre of 0–10–20 or 0–9–27. On the soils not so rich in organic matter, apply 3–9–18 for oats and use the heavier rate of application if hay mixture is to seeded with them. The fertilizer used for wheat should always contain, in addition to the phosphate

and potash, some quickly available nitrogen to hasten fall growth. The 3–9–18 analysis is recommended as meeting the requirements of wheat and should be applied at the same rate as for oats.

Alfalfa, where it can be grown, should receive 200 to 300 pounds an acre of 0–10–20 or 0–9–27 fertilizer at seeding time. Seeding should usually be done after a good rain late in July or early in August on summer-fallowed or deeply disked grain-stubble land. Cultipacking the soil makes a firm seedbed that will encourage a good stand and uniform early growth. To maintain good yields and prolong the life of the stand, a top dressing of 200 pounds an acre of the same kind of fertilizer as that used at seeding should be applied every spring.

Permanent pastures should be top-dressed with 300 to 400 pounds an acre of 0–10–20 every 3 or 4 years.

For vegetables and other specialized crops that may be grown on these soils, special fertilization will be needed. Specific recommendations for each crop can be obtained from the Purdue University Agricultural Experiment Station at Lafayette.

ORGANIC SOILS

The organic soils are Edwards muck and its burned phase, Edwards loamy muck, Houghton muck and its shallow phase over sand and burned phase over sand, and Houghton loamy muck over sand. Together, these soils occupy 7,209 acres, or 2.7 percent of the county. The burned phases of both Edwards and Houghton mucks have been severely damaged by burning. Much, and in places all, of the organic matter and nitrogen originally contained has been destroyed through burning, and as a result many areas are now of little or no agricultural value.

The profitable management of muck soils involves careful drainage, the control of wind erosion when the light surface muck is dry, the growing of suitable crops, and the application of relatively large quantities of mineral fertilizer rich in potash.

DRAINAGE

Proper drainage is the first requisite in improving muck soils. Usually the water table should be lowered to about 3 feet below the surface. For meadows and pastures, 2 feet may be enough for best results. Muck soils will drain freely if outlets for the water are available, and it is not necessary that ditches or tile lines be so closely spaced as in heavier soils. Ordinarily, the distance between tile lines or lateral ditches should be about 100 feet. Whether tile lines or open ditches should be used depends on local conditions. If the subsurface material is firm enough to hold tile in place, tiling is preferable. Open ditches are always a nuisance and are expensive to maintain. In extensive areas large open-outlet ditches may be necessary, but they should be no deeper than is necessary to provide outlets for the tile lines and keep the water table at a level suitable for the crops grown.

Most muck areas receive considerable surface and seepage water from adjacent higher lands, and the plan of drainage should provide for the removal of seepage as well as excess rainwater that falls on the muck area itself. As the first step in establishing proper drainage, cut a ditch or lay a line of tile along the edge of the muck next to the

adjoining higher land. This line will catch runoff and seepage water from the higher land and make drainage of the muck area comparatively easy, provided a suitable outlet can be procured. Where tile drains are used, the lines of tile must be deep enough so the settling of the soil will not leave them too near the surface. Muck settles considerably after drainage and under cultivation. The ultimate aim should be the holding of the water table 2½ to 3 feet below the surface.

Great care must be exercised in establishing an even grade for each line of tile, for the water must flow to the outlet without any checking of current. Fine material washed in at the tile joints settles easily and will soon clog the tile line if the grade is uneven. As a rule, nothing smaller than a 5-inch tile should be used in muck soils. It is a good plan to cover the tile lines with a few inches of straw or grass and weeds before filling in the ditches. In some areas it may be desirable to raise or hold the water table when the dry season of the year approaches. This may be especially desirable for shallow-rooted crops. The water table can be held up, to some extent at least, by damming the ditches or blocking the tile outlets until sufficient rain comes again.

LIMING

Edwards muck and Edwards loamy muck are neutral to alkaline and do not need liming. Some areas of Edwards muck are shallow in depth to underlying marl and therefore so strongly alkaline that they are unfavorable for some crops. The Houghton mucks vary from slightly acid in the deeper areas to strongly acid in areas where underlying sand is at shallow depths. The quantity of lime required on a particular field should be determined by acidity tests.

CROPS

In all except the very badly burned areas, organic soils will produce a considerable variety of crops if they are properly drained and fertilized and limed where necessary. For the general farmer, corn is the most popular crop. With proper fertilization corn can be grown most of the time, but only early maturing varieties should be used to lessen the risk of damage by early frost.

Barley, oats, and wheat are the least suitable small grains for muck soils because they are apt to produce a rank growth of weak straw that will lodge badly. Soybeans have stiffer stems and are much better suited than small grains. Occasionally a crop of rye, followed by mixed timothy and alsike clover for meadow or pasture, may be fitted into the rotation. Sudan grass and sorghum are other crops that may be grown on both the mucks and loamy mucks. Bluegrass pastures last indefinitely on these soils and produce well if phosphate and potash are applied and weed control is practiced. The Houghton soils are well suited to potatoes, but the Edwards soils are generally too alkaline.

When satisfactory markets and necessary labor are available, specialized truck farming is well suited to the muck soils adaptable for farming. Onions, beets, carrots, parsnips, turnips, celery, lettuce, cabbage, and cauliflower can be grown under proper management. Details concerning management practices for any of these crops can be obtained from the Department of Horticulture, Purdue University Agricultural Experiment Station, Lafayette.

968813—55—9

IMPORTANCE OF COMPACTING MUCK SOILS

The looseness of the surface material is apt to be a source of difficulty in managing muck soils. In preparing the seedbed it is therefore important that the ground be thoroughly packed by using heavy corrugated rollers. Roll the field more than once if necessary. A thorough compacting of the muck before planting helps to get more uniform germination of seeds, a better early growth, and also lessens the danger of early frost damage to immature crops.

WINDBREAKS

Wind erosion during early dry periods, with the attendant blowing out of tender crops while they are still small, is a problem on muck soils. Planting a row of rye between every few rows of the crops that have tender seedlings is the simplest practice to prevent wind erosion. Some farmers also protect their fields with hedgerows of suitable shrubs or trees. These windbreaks are planted crosswise to the direction from which the most damaging winds come.

FERTILIZATION

Potash is of first importance in the fertilization of highly organic soils and should be the principal constituent in the fertilizer applied. The supplies of phosphorus are also low in these soils. Nitrogen is present in great abundance in all areas except those badly burned and need be applied in fertilizer only for some early planted vegetable crops. These early crops need quickly available nitrogen before the soil is warm enough for the process of nitrification to be fully underway. Nitrification is the bacterial action that makes soil nitrogen available.

In general farming, corn should be fertilized with 0–9–27 on the mucks and with 0–10–20 on the loamy mucks. The rate of application should be 500 to 800 pounds an acre. Plow under two-thirds of the fertilizer shortly before planting and apply one-third on both sides of the hill or the row at planting time by using a divided fertilizer attachment on the planter. Soybeans should be fertilized in the same way. For sorghum, Sudan grass, or rye the fertilizer may be drilled with the seed, broadcast and disked in, or placed 4 to 5 inches deep in the soil before seeding by using a fertilizer attachment on a disk grain drill. Bluegrass pasture should be top-dressed with 0–10–20 on the mucks and with 0–12–12 on the loamy mucks. On areas just brought under cultivation, applications of partly rotted manure will be helpful in supplying the beneficial bacteria often lacking in newly cultivated mucks.

The truck and garden crops that may be grown on these soils will need special fertilization. Information concerning fertilization for each crop and soil condition can be obtained from the Department of Horticulture, Purdue University Agricultural Experiment Station, Lafayette.

BOTTOM LANDS

The bottom, or overflow, lands of the county are Griffin loamy fine sand, fine sandy loam, and loam; Kaskaskia silt loam; and Wabash silt loam and silty clay loam. Together, these soils occupy 5,393 acres, or about 2.1 percent of the county.

DRAINAGE

Natural drainage of the bottom land soils is limited by the periodic overflows and, in the finer textured areas, by a slowly permeable subsoil. Artificial drainage of the areas only slightly elevated above the streams is not feasible, and most of such land is agriculturally useful only for pasture. The more elevated areas with a fairly heavy subsoil would drain out more rapidly after subsidence of floodwater and after heavy rains if they were provided with some tile underdrainage.

LIMING

Kaskaskia silt loam is slightly acid and may respond to light liming, but Griffin and Wabash soils are practically neutral in reaction and do not need liming.

ORGANIC MATTER AND NITROGEN

The Griffin soils are only medium in organic-matter and nitrogen content, and areas that can be used for cultivated crops should be so managed as to return to the land all unused crop residues. Cornstalks, straw, and other crop residues should never be burned, as this destroys both organic matter and nitrogen. The Kaskaskia and Wabash soils are naturally fairly well supplied with organic matter and nitrogen, and with reasonable care in their management, no special provisions for building up these constituents are required. Cornstalks and straw not otherwise utilized, however, should be left on or returned to the land.

CROP ROTATION

On the limited areas of bottom land that can be used for cultivated crops, corn, soybeans, and such late-planted spring crops are most practical. Corn is usually most profitable and on the more fertile areas can be satisfactorily grown for years in succession. A soybean crop fits well as an alternate with corn when it can be used to advantage. On some of the more elevated areas where flooding is of short duration, oats can be satisfactorily rotated with corn and soybeans. Nearly all areas of these bottom lands will produce good bluegrass pasture.

FERTILIZATION

The overflow bottom lands that periodically receive deposits of fine soil material from fertile uplands or terraces do not need much fertilizer, but there are places where crop yields can be profitably increased by applying a phosphate-potash mixture. Place the phosphate on both sides of the hill or the row for corn and on both sides of the row for soybeans. The application can be made in this way by using a divided fertilizer attachment on the planter.

NONARABLE LAND

Nonarable lands are the badly wind-eroded phases of the Berrien, Coloma, Plainfield, and Weiss soils; practically all of the Bridgman and Wooten soils; and the badly water-eroded areas of the Parr, Miami, and Tuscola soils. Areas of these soils under cultivation that cannot be protected against destructive erosion by good farming practices should be retired to permanent pasture or should be reforested with suitable trees and protected against browsing by livestock. Erosive areas still wooded should not be cleared. Gravel and sand pits, which occupy 66 acres in the county, are also nonarable.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of weathering and soil development acting on parent soil material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material, (2) the climate under which the material has accumulated and has existed since accumulation, (3) the plant and animal life in and on the soil, (4) the relief or lay of the land, and (5) the length of time the forces of development have acted on the soil material. These forces and features are interacting; thus, the effects of climate on soils and plants depend not only on temperature, rainfall, and humidity but also on the physical characteristics of the soil or soil material and on the relief, which, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

ENVIRONMENT AND CHARACTERISTICS OF THE SOILS

The soils of Newton County have developed from drift materials of the Late Wisconsin glaciation. These materials consist of glacial till, glaciofluvial outwash, and glaciolacustrine sands, silts, and clays.

The soils in the southern part of the county, or those occupying the Marseilles moraine and Iroquois lacustrine sections and Tipton Till Plain, have developed, for the most part, under a grassland vegetation. This part of the county is an eastern extension of the Prairie soils region that extends westward into Illinois and Iowa. The surface and upper subsoil horizons of these soils are dark and high in organic content.

Small tracts adjacent to the Iroquois River, the sandy dunelike areas, and the light-colored sandy areas in the Kankakee lacustrine section have developed under a heavy forest cover of deciduous trees and belong to the Gray-Brown Podzolic great soil group. The dark very poorly drained soils in the Kankakee lacustrine section have developed under a marsh grass vegetation, with subsequent encroachment of deciduous trees on some areas.

The parent material of soils in the Marseilles moraine and the Tipton Till Plain areas is largely a deposit of unconsolidated silt, clay, sand, and rock fragments, but there are small bodies predominantly of sand and a few of stratified gravel. The material in the morainic section is, in general, lighter textured and somewhat more variable than that of the till plain. The Iroquois lacustrine section is made up of lake-deposited material and of glaciofluvial outwash of stratified sand, silt, and clay, with minor quantities of fine gravel, underlain by unconsolidated and unassorted till material at varying depths. The material in the Kankakee lacustrine section is practically all sand, with which heavier textured materials occur in only relatively small areas. Some of the sand has been reworked into dunes by the wind, and these dunes have been held in place a long time by forest vegetation. The low-lying areas of dark associated soils were developed under a marsh vegetation, and the water table was at or above the surface for extended periods.

In the county are zonal soils represented by the Prairie (Brunigra) and Gray-Brown Podzolic soils; intrazonal soils, by the Humic Gley, Low Humic Gley, and the Bog soils; and azonal soils, by the Alluvial soils.

County, Ind. [1]

t soil group

Gray-Brown Podzolic soils			Low Humic Gley soils [4]		Alluvial soils		Bog soils
IV	III Moderately well	II Imperfect	II Imperfect	IX Very poor	IV Well	II Imperfect	X Very poor.
y level to mod-ely steep.	Nearly level to undulating.	Nearly level	Nearly level	Nearly level to depressed.	Nearly level	Nearly level	Depressions or broad depressed flats.
sh brown to owish brown.	Grayish brown to yellowish brown.	Brownish gray	Brownish gray	Dark gray to gray	Dark grayish brown	Brownish gray to yellowish gray.	Very dark brownish gray to black.
wish brown to wnish yellow.	Yellowish brown to pale brown.	Mottled gray, yellow, and brown.	Mottled gray, yellow, and brown.	Gray	Dark grayish brown to dark brown.	Yellowish gray, mottled with yellow and brown.	Very dark gray
	Mottled gray and yellow.	do	do	do	Brown	Mottled yellow, gray, and brown.	Brown, yellow, gray.
	do	do	do	do	do	do	Do.
i		Crosby					
ND LAKE PLAINS							
la		Kibbie					
	Berrien		Morocco				
			Weiss	Conrad			
			Wooten				
					Kaskaskia		
						Griffin	
							Edwards.
							Houghton.

Humic Gley soil group includes soils formerly recognized as Gray Hydromorphic soils.
e necessarily general and may not conform in detail to the colors given in individual soil descriptions; surface colors are for cultivated areas.
is not a true Prairie soil but constitutes a transition from Prairie to Gray-Brown Podzolic soils.

968833—55 (Face p. 132)

A key to the soil series of the county is presented in table 11. The great soil groups in part follow the soil classification given in the Yearbook of Agriculture, 1938.[6] The Roman numerals and the form of classification, in general, are based on the Indiana system of soil profile designation.[7] The soil series listed in columns under each of these numerals have similar natural drainage but differ in profile characteristics because they have developed on different parent material. Soil series listed in a horizontal line in the columns are developed from similar parent material, the differences in their profiles being mainly the result of differences in natural drainage conditions prevailing during their development, or to natural vegetation.

PRAIRIE SOILS

The Prairie soils are zonal and have developed under a tall prairie-grass vegetation. They have dark eluviated A horizons high in content of organic matter; illuviated B horizons varying from dark; grayish brown throughout to mottled gray, yellow, and brown in the lower part; and C horizons composed of physically weathered and in some degree chemically weathered material. The Prairie soils are members of the Parr, Corwin, Swygert, Clarence, Ayr, Deardurff, Stockwell, Ade, Jasper, Foresman, Tippecanoe, Alida, Hagener, Odell, Darroch, and Strole series. The well-drained Parr soils, developed on unassorted glacial till, are good examples of zonal Prairie soils.

Following is a profile description of Parr silt loam, undulating phase, taken in the southwest quarter of the southeast quarter of section 31, township 27 north, range 8 west:

A_{11}. 0 to 2 inches, very dark-gray friable silt loam containing a mass of grass roots; organic content is high (10.4 percent[8]); material has small granular structure aggregates; soft when moist and firm but not hard when dry; pH, 7.0.[9]

A_{12}. 2 to 12 inches, dark brownish-gray or dark grayish-brown friable silt loam somewhat lower in organic content (6.4 percent) than the above horizon; granular structure, the aggregates being ⅛ to ¼ inch in diameter and firm but not hard; physical condition and organic content are such that aggregates absorb moisture readily; pH, 6.1.

A_{13}. 12 to 15 inches, dark grayish-brown heavy silt loam of small nuciform or coarse granular structure; aggregates are ⅛ to ½ inch in diameter; organic content is slightly lower (5.6 percent) than in horizon above; aggregates are firm in place but are easily crushed into minute aggregates; few small pebbles are present; pH, 6.0.

B_{21}. 15 to 19 inches, brown silty clay loam that breaks into rather distinct nuciform aggregates ⅜ to ¾ inch in diameter; organic content is 2.4 percent; contains a few small pebbles and an occasional larger stone; pH, 5.1.

B_{22}. 19 to 28 inches, yellowish-brown gritty silty clay loam with nuciform aggregates ½ to 1½ inches in diameter; aggregates easily crushed when moist but become hard when dry and have a thin gray coating on some of their cleavage faces in the lower part of the horizon; coating gives material a slightly mottled appearance in place but this disappears on crushing; contains small pebbles and an occasional larger stone; pH, 5.2.

---

[6] BALDWIN, M., KELLOGG, C. E., and THORP, J. SOIL CLASSIFICATION. U. S. Dept. Agr. Yearbook 1938 (Soils and Men): 979–1001. 1938.

[7] BUSHNELL, T. M. THE STORY OF INDIANA SOILS. Dept. of Agron., Purdue Univ. Agr. Expt. Sta., Spec. Cir. No. 1, 52 pp., illus. 1944.

[8] Organic determinations made by Purdue University Agricultural Experiment Station.

[9] pH determination made by colorimetric method in the field.

B_{23}. 28 to 33 inches, brownish-yellow friable gritty silt loam containing many small pebbles; breaks into nuciform aggregates ¾ to 2¼ inches in diameter; pH, 6.5.

C_1. 33 inches +, brownish-yellow light clay loam calcareous till containing many angular pebbles and rock fragments.

Parr soils of this county vary from the profile just described in texture and thickness of the various horizons. Within a given type the chief variability is the occurrence here and there of more sandy materials in all horizons. This sandy material occurs as pockets of various sizes, or may be in small areas, and is especially evident in lighter textured types on the Marseilles moraine.

The moderately well drained Corwin soils are developed on calcareous glacial till under a tall prairie-grass vegetation. They belong to the Parr soil catena. The following describes a profile of cultivated Corwin silt loam taken in the northeast quarter of the northeast quarter of section 36, township 27 north, range 10 west:

A_{1p}. 0 to 6 inches, very dark-gray friable silt loam high in organic content (6.4 percent); fine granular structure aggregates firm but not hard and absorb moisture readily; pH, 6.4.

A_{12}. 6 to 11 inches, very dark brownish-gray friable silt loam of medium granular structure; structure aggregates are somewhat larger than in the above horizon; organic content high (8.0 percent); pH, 5.9.

A_{13}. 11 to 16 inches, dark brownish-gray heavy silt loam; breaks into coarse granular aggregates easily crushed when moist; organic-matter content, 6.4 percent; pH, 5.7.

B_{21}. 16 to 19 inches, pale grayish-brown silty clay loam; nuciform structure aggregates ⅛ to ¼ inch in diameter; organic matter content, 6.4 percent; pH, 5.7.

B_{22}. 19 to 26 inches, mottled yellow, brown, and gray silty clay loam; nuciform structure aggregates ¼ to ½ inch in diameter; organic-matter content, 1.4 percent; pH, 5.7.

B_{23}. 26 to 32 inches, mottled yellow, light-gray, and brown gritty silty clay; nuciform structure aggregates ½ to 2 inches in diameter and their cleavage faces have a thin coating of dark-gray colloidal clay; pH, 6.2.

C_1. 32 inches +, gray and yellow heavy loam calcerous glacial till.

Corwin silt loam may vary in thickness and texture of the various horizons.

Odell soils are imperfectly drained, have thicker and darker A horizons than the Corwin soils, and have mottled B horizons.

Swygert soils have drainage conditions similar to those of the Corwin soils, thinner A horizons and heavier textured B horizons, and are developed on heavier textured calcareous glacial till.

Clarence soils, less well drained than the Parr and Swygert, are developed on very heavy-textured glacial till. The A horizons are thinner than those of the Parr and Swygert, the B horizons are of silty clay to clay texture and usually mottled, and the C horizon is calcareous clay glacial till.

The two phases of Ayr fine sandy loam mapped consist of a relatively thin (20 to 40 inches) smear of sandy material over unassorted glacial till. The following describes a profile of Ayr fine sandy loam, undulating phase, taken in the southwest quarter of the northeast quarter of section 22, township 29 north, range 9 west:

A_{11}. 0 to 2 inches, dark brownish-gray very friable fine sandy loam containing a mass of bluegrass roots; organic content is high (12.0 percent); when dry, the gray and yellow sand grains stand out in contrast to the dark organic matter; pH, 7.0.

A_{12}. 2 to 13 inches, dark brownish-gray very friable fine sandy loam containing some grass roots; organic content (9.6 percent) is lower than in the above horizon; pH, 6.8.

A_{13} 13 to 23 inches, dark grayish-brown loose fine sandy loam; organic content, 7.2 percent; pH, 6.1.

B_{21}. 23 to 29 inches, brown fine sandy loam containing enough heavier materials to hold it together somewhat; pH, 5.3.

B_{22}. 29 to 40 inches, brownish-yellow sandy clay loam, containing a few pebbles and stones; pH, 5.0.

B_{23}. 40 to 55 inches, yellow to brownish-yellow sandy and gritty silty clay loam containing many partly weathered angular pebbles and stones; breaks into irregular-sized angular chunks that become hard when dry; pH, 5.6.

D. 55 inches +, brownish-yellow calcareous loam glacial till.

Deardurff fine sandy loam is a moderately well drained soil characterized by sandy deposits over calcareous unassorted glacial till. It developed under a tall prairie-grass vegetation. The following profile is under a bluegrass cover, taken in the southwest quarter of the southeast quarter of section 34, township 27 north, range 8 west:

A_{11}. 0 to 1½ inches, very dark-gray fine sandy loam high in organic matter content (11.2 percent); contains a mass of grass roots and enough heavy material and organic matter to hold the sand grains together when moist but is rather loose when dry; pH, 7.0.

A_{12}. 1½ to 7 inches, very dark-gray fine sandy loam relatively high in organic content (5.6 percent); grass roots are numerous; pH, 7.0.

A_{13}. 7 to 10 inches, dark grayish-brown fine sandy loam slightly lower in organic content than the above horizon (4.8 percent); pH, 6.9.

B_1. 10 to 15 inches, yellowish-brown slightly coherent fine sandy loam; organic content, 1.2 percent; appears compact in place but breaks out easily into small particles; pH, 6.8.

B_{21}. 15 to 25 inches, brownish-yellow sandy loam faintly mottled and streaked with brown; pH, 5.9.

B_{22}. 25 to 33 inches, mottled yellow and brown loamy sand; appears compact in place but falls apart easily when disturbed; pH, 6.2.

B_{23}. 33 to 41 inches, mottled brownish-yellow, brown, and gray sandy loam slightly coherent when moist; pH, 6.2.

C. 41 to 60 inches, highly mottled and blotched light-gray, yellow, and brown loamy sand; pH, 6.8.

D. 60 inches +, gray and yellow calcareous unassorted glacial till composed of silt, clay, sand, rock flour, and angular rock fragments.

Deardurff fine sandy loam may vary from the above description in depth to underlying calcareous glacial till and in the acidity of the horizons above the D horizon.

The two phases of Stockwell loam are developed on the kamelike topography of the Marseilles moraine and are characterized by being underlain with loose calcareous usually cross-bedded gravel. Stockwell soils may be considered Prairie equivalents of Bellefontaine soils, which developed under a cover of deciduous trees and are not mapped in this county.

An area of Stockwell loam, undulating phase, in the northwest quarter of the southeast quarter of section 4, township 28 north, range 9 west, shows the following profile characteristics:

A_{1p}. 0 to 7 inches, dark brownish-gray friable loam having some small pebbles on the surface and throughout; organic content, 6.4 percent; structure aggregates are small, granular, rather soft, and may be crushed easily; pH, 6.6.

A_{12}. 7 to 15 inches, dark grayish-brown friable loam containing many pebbles; organic content, 6.4 percent; breaks into medium to coarse granules that are easily crushed; pH, 6.6.

A_{13}. 15 to 18 inches, dark-brown slightly sticky sandy loam with penetrations of dark grayish-brown from the above horizon; contains many

rounded pebbles and appears compact in place but breaks into small angular aggregates when disturbed; organic content, 2.0 percent; pH, 5.9.

B_{21}. 18 to 22 inches, brown slightly waxy gravelly and sandy loam that breaks into small angular chunks; pH, 6.0.

B_{22}. 22 to 48 inches, brown waxy and gravelly clay loam; breakes into irregular-sized angular chunks; when moist, aggregates may be crushed into smaller ones without much pressure but are hard when dry; pH, 6.3.

B_{23}. 48 to 51 inches, very dark brownish-gray gravelly clay loam that breaks into large angular chunks; pH, 6.8.

D. 51 inches +, loose calcareous gray and pale-yellow gravel.

In thickness of the various horizons Stockwell loam, undulating phase, is variable, and the acidity of the B_{21} and B_{22} horizons is normally lower than in the profile described.

Ade loamy fine sand, undulating phase, is derived from thick accumulations of sand and usually occurs in slightly higher and more rolling areas, where it is associated with Parr soils. It may be considered the Prairie equivalent of Coloma soils, which are developed under a forest of deciduous trees.

The following describes a profile of Ade loamy fine sand, undulating phase, under a good stand of Kentucky bluegrass, as taken in the southeast quarter of section 36, township 29 north, range 9 west:

A_{11}. 0 to 2 inches, dark brownish-gray loose loamy fine sand containing a mass of grass roots; high organic content (6.4 percent), together with the slight content of heavier material, gives a slight coherence to the soil when moist; pH, 6.0.

A_{12}. 2 to 16 inches, dark grayish-brown loose loamy fine sand containing many grass roots; organic content (5.6 percent) slightly lower than horizon above; pH, 6.2.

A_{13}. 16 to 25 inches, dark-brown loose loamy fine sand; organic content, 1.4 percent; pH, 6.3.

B_{21}. 25 to 39 inches, brownish-yellow loose loamy fine sand streaked with dark-brown penetrations from horizon above; pH, 5.9.

B_{22}. 39 to 45 inches, brownish-yellow loamy fine sand containing a few spots of sandy clay material; pH, 5.7.

C_1. 45 to 54 inches, light brownish-yellow fine sand with streaks and blotches of dark-brown light sandy clay; pH, 5.7.

C_2. 54 to 65 inches, brown fine sandy loam constituting a thick liesegang seam; pH, 5.8.

C_3. 65 to 70 inches, light grayish-yellow loamy fine sand; pH, 6.3.

C_4. 70 to 77 inches, yellowish-brown fine sand streaked with grayish yellow; pH, 6.1.

C_5. 77 to 96 inches, grayish-yellow loose fine sand; pH, 6.8.

C_6. 96 to 103 inches, mottled brown and yellow sandy clay loam that breaks into chunks of irregular size and shape; pH, 6.9.

D. 103 inches +, gray and light yellow calcareous glacial till.

Ade loamy fine sand, undulating phase, varies in depth to the underlying till material and in thickness of the organic-matter bearing horizons.

Jasper soils are developed on glaciofluvial and lake plain deposits in the Iroquois lacustrine section. The following profile describes Jasper loam, undulating phase, in the southwest quarter of the southwest quarter of section 2, township 27 north, range 10 west:

A_{1p}. 0 to 7 inches, dark brownish-gray or dark grayish-brown friable loam; organic content, 5.6 percent; structure aggregates are granular, soft, and absorb moisture readily; pH, 6.0.

A_{12}. 7 to 10 inches, dark grayish-brown friable loam; organic content, 2.1 percent; breaks into coarse granular aggregates that are easily crushed; pH, 5.5.

A_{12}. 10 to 15 inches, dark-brown sandy loam containing enough heavier material to be slightly compact in place; when dry, material falls apart into small weakly developed nuciform aggregates; pH, 5.4.

B_{21}. 15 to 20 inches, brown sandy clay loam; breaks into nuciform aggregates ¼ to ¾ inch in diameter; structure aggregates easily crushed when moist but hard when dry; pH, 5.1.

B_{22}. 20 to 28 inches, brownish-yellow sandy clay loam; breaks into nuciform aggregates ½ to 1¼ inches in diameter; pH, 5.2.

D_1. 28 to 39 inches, brownish-yellow feeble coherent sand; appears firm in place but breaks into rather loose sand; pH, 5.6.

D_2. 39 to 54 inches, yellowish-brown sandy clay loam that breaks into chunks of irregular size and shape; pH, 5.9.

D_3. 54 inches +, gray and yellow calcareous sands and silts with thin layers of clay.

Jasper soils vary in texture of all horizons and in the composition of underlying material. The stratified sand, silt, and clay material in many places has a total depth of several feet.

Foresman soils are moderately well drained and belong to the Jasper soil catena. Mottling occurs between depths of 16 and 26 inches, and the soils are underlain by stratified layers of sand, silt, and clay with which occur small quantities of fine gravel.

The moderately well drained Tippecanoe loam is developed on stratified calcareous glaciofluvial gravel. Development was under a prairie vegetation, and the soil has dark surface and upper subsoil horizons high in organic content. Mottling occurs at a depth of 16 to 26 inches.

Alida loamy fine sand occurs in areas transitional from prairie to forest vegetation and is developed on noncalcareous sandy material. It is moderately well drained; has dark surface soil and upper subsoil, the subsoil being mottled below a depth of 16 to 28 inches; and is underlain by loose noncalcareous sand. The Alida soil in this county differs from Alida soils mapped in La Porte and St. Joseph Counties in having lighter textured surface soil and subsoil and in the lack of small shale fragments in the underlying material.

Hagener soils are much like the Ade soils in profile characteristics but are usually less acid. They occupy the ridges and dunelike tracts of the Iroquois lacustrine section and are associated with Jasper soils. Hagener soils probably are derived from an accumulation of wind-reworked material.

Darroch soils are developed on lacustrine and outwash material composed of calcareous stratified layers of sand, silt, and clay with minor quantities of gravel. They belong to the Jasper soil catena. A cultivated area of Darroch silt loam in the northwest quarter of the northwest quarter of section 11, township 28 north, range 8 west, has the following profile characteristics:

A_{1p}. 0 to 6 inches, very dark-gray friable silt loam; organic-matter content, 4.0 percent; medium crumb or granular structure; pH, 7.4

A_{12}. 6 to 9 inches, dark brownish-gray friable silt loam of coarse crumb structure; organic content, 3.7 percent; pH, 6.9.

A_{13}. 9 to 12 inches, dark brownish-gray friable silt loam marked with faint brownish-yellow streaks and mottles; coarse granular structure; pH, 5.4.

B_1. 12 to 15 inches, mottled pale-yellow, gray, and brown friable heavy silt loam; breaks into small nuciform aggregates; pH, 5.2.

B_2. 15 to 24 inches, mottled yellow, gray, and brown silty clay loam; material breaks into nuciform aggregates ⅛ to ¾ inch in diameter; pH, 5.4.

D_1. 24 to 32 inches, mottled yellow, brown, and gray very fine sandy clay loam that contains thin seams of fine sand; pH, 7.1.

D_2. 32 to 48 inches +, mottled light-gray, pale-yellow, and brown stratified calcareous fine sand, clay loam, and clay.

In thickness and sequence the different textured layers of the D_1 and D_2 horizons vary in this and other Darroch soils.

Strole soils are developed on highly calcareous lacustrine clay. The following describes a profile of Strole silt loam under bluegrass cover in the northwest quarter of the northwest quarter of section 24, township 28 north, range 8 west:

A_{11}. 0 to 2 inches, very dark-gray friable silt loam; contains a mass of grass roots and has a fine granular structure; organic-matter content, 8.8 percent; pH, 7.8.

A_{12}. 2 to 10 inches, very dark brownish-gray friable silt loam; medium granular structure aggregates are soft when moist and firm when dry; organic content, 8.0 percent; grass roots are numerous in the upper part and diminish somewhat with depth; pH, 6.9.

A_{13}. 10 to 14 inches, dark brownish-gray heavy silt loam that breaks into coarse granular and fine nuciform aggregates; organic content, 3.0 percent; pH, 6.5.

B_1. 14 to 17 inches, mottled gray and pale brownish-yellow silty clay loam; breaks into blocky aggregates ¼ to ½ inch in diameter; pH, 6.2.

B_{21}. 17 to 25 inches, brown and gray silty clay mottled with pale yellow; breaks into well-developed blocky aggregates ⅜ to 1½ inches in diameter; plastic when moist and hard when dry; pH, 5.8.

B_{22}. 25 to 29 inches, mottled yellow, brown, and gray smooth clay; thin coating of dark-gray material shows on most of the cleavage faces; breaks into blocky aggregates ¾ to 2 inches or more in diameter; plastic when moist and very hard when dry; pH, 7.0.

C. 29 to 40 inches +, mottled dull-brown, pale-yellow, and gray highly calcareous smooth clay that breaks into large blocky aggregates.

GRAY-BROWN PODZOLIC SOILS

The Gray-Brown Podzolic soils occur in a narrow belt adjacent to the Iroquois River, in the northern part of the Marseilles moraine, and on the sand dune tracts of the Kankakee lacustrine section. They have developed under a heavy forest cover of deciduous trees, and members of the Miami, Crosby, Coloma, Tuscola, Kibbie, Plainfield, Bridgman, and Berrien series are included in this group.

The Miami soils have developed on deposits of unassorted silt, sand, gravel, and clay left by the retreating ice sheet.

The following describes a profile of Miami silt loam, moderately steep phase, under a forest cover of white, red, and shingle oaks, hickory, ash, and elm in the northeast quarter of the southwest quarter of section 5, township 27 north, range 9 west:

A_0. Thin accumulation of partly decayed leaves, twigs, and other forest litter.

A_{11}. 0 to 1½ inches, dark brownish-gray friable silt loam; organic-matter content, 8.0 percent; small crumb structure aggregates are soft and easily crushed; contains a mass of tree feeder roots; pH, 7.0.

A_{12}. 1½ to 3 inches, dark grayish-brown friable loam having medium-sized firm but not hard crumb structure aggregates; worms are active and roots are numerous; 3.2 percent organic matter; pH, 6.5.

A_2. 3 to 9 inches, light yellowish-brown friable silt loam of coarse crumb structure: organic-matter content, 1.4 percent; horizon contains small worm casts of dark-gray material; pH, 5.7.

B_1. 9 to 13 inches, brownish-yellow heavy silt loam; nuciform aggregates are ¼ to ¾ inch in diameter; contains a few angular partly weathered pebbles; pH, 5.1.

B_{21}. 13 to 34 inches, brownish-yellow gritty silty clay loam; nuciform aggregates are ¾ to 1¼ inches in diameter and are easily crushed when moist but hard when dry; contains numerous small partly weathered pebbles and an occasional larger stone; pH, 5.2.

B_{22}. 34 to 40 inches, brownish-yellow gritty silty clay loam; breaks into very coarse nuciform aggregates thinly coated with dark gray colloidal clay on many of the cleavage faces; pH, 6.9.

C_1. 40 inches +, brownish-yellow calcareous light clay loam glacial till.

Crosby silt loam is an imperfectly drained soil developed under a deciduous forest on unassorted glacial till material similar to that on which Miami soils are developed. The following detailed profile description of Crosby silt loam, under soybean cover, was taken in the northwest quarter of the northeast quarter of section 6, township 27 north, range 9 west:

A_{1p}. 0 to 6 inches (plowed layer), light brownish-gray friable silt loam; medium crumb structure aggregates are firm but not hard; organic content, 2.5 percent; pH, 6.9.

A_2. 6 to 9 inches, mottled gray and yellow friable gritty silt loam; coarse granular structure aggregates are firm; organic content, 2.1 percent; pH, 6.2.

B_1. 9 to 12 inches, mottled light-gray and brownish-yellow gritty silty clay loam; breaks into nuciform aggregates ⅛ to ½ inch in diameter; organic content, 0.9 percent; small partly weathered pebbles are numerous; pH, 6.2.

B_2. 12 to 29 inches, mottled light-gray and yellow gritty silty clay loam of nuciform structure; aggregates are ¼ to 1¼ inches in diameter and hard when dry but when moist may be further broken down into smaller nuciform aggregates; pH, 5.5.

C_1. 29 inches +, gray and yellow light clay loam calcareous glacial till.

Crosby silt loam varies in texture of horizons other than that at the surface, in thickness and in reaction of the A and B horizons, and in the depth to the C horizon.

The two phases of Coloma loamy fine sand are derived from an accumulation of sandy material underlain by calcareous glacial till material below a depth of 5 feet. They occur in slightly higher and more rolling areas than Miami soils or as long dunelike areas. Large stones scattered on the surface and in the soil mass discredit the assumption that the rolling and dunelike areas are purely the result of the action of wind. The phases of Coloma loamy fine sand may be considered as the forested equivalents of Ade soils.

Tuscola soils are developed on stratified silt, clay, and fine sand under a forest cover of deciduous trees. Some areas are transitional between prairie-grassland and timber vegetation.

Kibbie soils are imperfectly drained and are developed on glaciofluvial outwash and lake-plain deposits. The surface soil is brownish gray, but the profile becomes mottled gray and yellow in the A_2 or A_3 horizon. The underlying material is stratified sand, silt, and clay, and in different areas each textural horizon varies greatly in thickness and sequence.

Plainfield soils consist of loose sand throughout and are derived from material accumulated by the action of wind and water. The shifting of the sand has resulted in the formation of dunes. Plainfield soils are very rapidly drained and therefore droughty.

Bridgman sand, wind-eroded undulating phase, is developed on loose sandy material and occurs on beach ridges and dunes. These deposits of sandy material are considerably younger than those on which Plainfield soils have developed. The Bridgman soil of this county differs from Bridgman soils mapped in Michigan in that its light-colored loose sandy material is underlain by dark sandy material at depths of 5 feet or more.

Berrien loamy fine sand occurs on the Kankakee lacustrine area in a position intermediate between Plainfield and Morocco soils. It has developed on loose sandy material. Drainage is good in the upper part of the profile but imperfect in the lower part because of a former high water table. The soil differs from Plainfield fine sand, undulating phase, in being mottled between a depth of 16 and 36 inches.

LOW HUMIC GLEY SOILS

The Low Humic Gley soils are the Morocco, Weiss, Wooten, and Conrad.

The Morocco soils are imperfectly drained and occupy low fixed dunes between areas of Plainfield or Berrien soils and dark very poorly drained Newton, Dillon, and other soils. They were developed under a deciduous forest. The following describes a profile of Morocco loamy fine sand having a fair stand of black and pin oaks, and a few white oak and blackgum trees that was taken in the southeast quarter of the northeast quarter of section 13, township 29 north, range 10 west:

A_0. Accumulated layer about one-fourth inch thick of partly decomposed leaves, twigs, and other forest litter.

A_1. 0 to ½ inch, very dark-gray loamy fine sand; organic-matter content, 6.7 percent; feeder roots of trees are numerous; pH, 4.6.

A_2. ½ to 4 inches, dark-gray loose loamy fine sand; organic-matter content, 3.2 percent; roots are numerous; pH, 4.3.

A_3. 4 to 8 inches, mottled dark-brown, yellow, and gray loose loamy fine sand containing a few brown mottles and spots; organic-matter content, 1.7 percent; organic penetration from the above layer is enough to somewhat darken this one; pH, 4.5.

B_{1g}. 8 to 20 inches, mottled yellow and gray loose fine sand; brown spots and blotches are larger and more numerous than in the above horizon; pH, 4.4.

B_{21g}. 20 to 28 inches, highly mottled and blotched light-yellow, light-gray, and brown loose medium sand; pH, 4.6.

B_{22g}. 28 to 36 inches, mottled light-gray and yellow fine sandy loam blotched and streaked with brown; somewhat compact in place but breaks out easily and crumbles under slight pressure; pH, 4.4.

C_1. 36 to 60 inches, brownish-yellow loose fine sand with a few brown specks and blotches; pH, 5.3.

C_2. 60 to 89 inches +, light grayish-yellow sand; pH, 5.7.

Weiss fine sand differs from Morocco soils in being neutral to alkaline in the surface soil and in being calcareous at a shallow depth. A few areas have hard iron-carbonate concretions on the surface. The soil occurs in the bed of the former Beaver Lake and is associated with Conrad fine sand in the Kankakee lacustrine section.

Wooten fine sand occurs in the area formerly covered by Beaver Lake. It occupies low dunes or slight elevations and lies higher than Conrad fine sand but lower than Bridgman sand, wind-eroded undulating phase. It consists of 20 to 36 inches of wind-blown sand deposited over former areas of poorly drained dark soils or over shallow muck areas.

Conrad fine sand has a 2- to 5-inch surface layer of dark-gray loamy fine sand and, underlying this, gray and yellow loose sand. Thin dark-gray sand layers occur irregularly below a depth of about 12 inches. The Conrad soil occupies shallower areas in the bed of the former Beaver Lake. The surface soil and upper subsoil are neutral, and the profile becomes calcareous below a depth of 36 inches.

HUMIC GLEY SOILS

The dark-colored and very poorly drained Humic Gley soils are characterized by a high humus content in the upper horizons and by a gray or brown and gray mottled subsoil. These soils are the Chalmers, Clyde, Rensselaer, Julian, Della, Maumee, Dillon, Newton, Granby, and Wabash.

Chalmers soils occupy the slight depressional areas and depressed flats in the upland prairie tracts of the county, which include the Marseilles moraine and the Tipton Till Plain. They are developed on glacial till material. The following is a detailed profile description of Chalmers silty clay loam occurring in the northwest quarter of the northwest quarter of section 34, township 27 north, range 9 west:

A_{11} 0 to 2 inches, very dark-gray to nearly black silty clay loam containing a mass of bluegrass roots; organic-matter content, 12.8 percent; fine granular structure aggregates are firm; pH, 7.5.

A_{12} 2 to 9 inches, very dark-gray silty clay loam of coarse firm granular structure; aggregates are rather easily crushed when moist but hard when dry; organic content, 8.8 percent; pH, 7.5.

A_{13} 9 to 15 inches, very dark-gray gritty plastic silty clay; breaks into angular aggregates ⅛ to ¼ inch in diameter; organic-matter content, 7.2 percent; contains a few small angular pebbles; pH, 7.4.

B_{21g} 15 to 20 inches, gray plastic silty clay with faint yellow and brown mottlings; breaks out into blocky aggregates ¼ to ¾ inch in diameter; pH, 7.7.

B_{22g} 20 to 25 inches, mottled gray and pale-yellow gritty silty clay containing many small angular partly weathered pebbles and an occasional larger stone; breaks into blocky aggregates ¼ to 2 inches in diameter; pH, 7.7.

B_{23g} 25 to 48 inches, mottled gray and pale-yellow gritty silty clay; breaks into large blocky aggregates very hard when dry; contains numerous pebbles; larger stones are more numerous than in above horizons; pH, 7.9.

B_{24g} 48 to 55 inches, mottled yellow and gray gritty silty clay with streaks of brown; breaks into blocky aggregates larger than those in the above horizon; aggregates are very hard when dry; rock fragments and pebbles are also more numerous than in horizon above; pH, 8.0.

C 55 inches +, gray and yellow calcareous clay loam glacial till.

Chalmers soils vary in the thickness and texture of all horizons and in the depth to calcareous till.

Clyde silty clay loam occupies the deeper depressional areas associated with Chalmers soils. The surface and subsurface horizons of Clyde soil are normally higher in organic content and thicker than comparable ones in Chalmers soils. The upper subsoil of Clyde soil is gray and shows very little if any mottling above a depth of 24 inches. The underlying calcareous glacial till is similar in both but is usually somewhat deeper below the surface in the Clyde than in the Chalmers.

Rensselaer soils occupy the shallow depressional tracts and broader flats of the Iroquois lacustrine area and are there associated with Jasper, Foresman, and other soils of that catena. The following is a profile description of Rensselaer silt loam taken under bluegrass cover in the southwest quarter of the southeast quarter of section 4, township 27 north, range 8 west:

A_{11} 0 to 2 inches, very dark-gray gritty friable silt loam of high organic content; medium-sized granular structure aggregates are firm but not hard; contains a mass of grass roots; neutral.

A_{12} 2 to 11 inches, very dark-gray gritty friable silt loam, high organic content and coarse firm granular structure; grass roots are numerous in the upper part but only a few are in the lower; neutral.

A_{13} 11 to 15 inches, dark-gray heavy silt loam of coarse granular to fine blocky structure; neutral.

A_3 15 to 19 inches, dark-gray gritty silty clay loam slightly mottled with brownish yellow; breaks into large blocky aggregates; when moist, aggregates can be further broken down into coarse granules without much pressure, but they are hard when dry; neutral.

B_{21g} 19 to 22 inches, dark-gray gritty silty clay with pale-yellow mottlings; contains many small rounded pebbles and breaks into large blocky aggregates, plastic when moist and hard when dry; neutral.

B_{22g} 22 to 28 inches, mottled yellow and brown gritty silty clay; contains many small rounded pebbles and has large blocky structure aggregates; neutral.

B_{23g} 28 to 42 inches, mottled yellow, light-gray, and brown sandy clay loam containing very thin seams or layers of fine sand and a few rounded pebbles; neutral.

D_1. 42 to 54 inches, bright-yellow fine sandy loam with light-gray and brown mottling; contains thin seams of fine sand and is calcareous.

D_2. 54 to 60 inches, mottled yellow, light-gray, and brown calcareous sandy clay loam.

D_3. 60 to 75 inches, mottled yellow and gray smooth calcareous silty clay in which occur very thin seams of fine sand.

D_4. 75 to 84 inches, yellowish-brown calcareous fine gravelly and sandy loam.

D_5. 84 to 95 inches +, yellowish-brown calcareous sandy loam with small spots and blotches of brown.

Rensselaer soils vary in thickness and texture of their horizons and in composition of underlying materials.

Della silty clay loam occupies the deeper depressional areas of the lake plain and is associated with Rensselaer soils. It has the same topographic relation to the Rensselaer soils as the Clyde has to the Chalmers soils. The surface and upper subsoil of the Della normally are higher in organic content and thicker than are corresponding horizons of the Rensselaer soils. The Della subsoil is gray and shows very little if any mottling above a depth of 30 inches.

Julian silty clay loam occupies shallow depressional areas associated with Strole soils and has developed on old lake deposits of heavy clayey material. It may be considered the Prairie equivalent of Toledo soils, which are not mapped in this county. The following is a profile description of Julian silty clay loam taken under an excellent bluegrass cover in the northeast quarter of the northeast quarter of section 24, township 28 north, range 8 west:

A_{11}. 0 to 2 inches, very dark-gray to nearly black silty clay loam containing a mass of bluegrass roots; fine granular structure aggregates are firm but can be crushed without much pressure when moist; organic content, 8.0 percent; neutral.

A_{12}. 2 to 7 inches, very dark-gray to nearly black silty clay loam of coarse granular structure; grass roots are numerous; organic-matter content, 8.0 percent; neutral.

A_{13}. 7 to 16 inches, very dark-gray silty clay of coarse granular to fine blocky structure; firm when moist and hard when dry; organic-matter content, 6.4 percent; neutral.

A_{14}. 16 to 20 inches, dark yellowish-gray silty clay that breaks into fine blocky aggregates ¼ to ¾ inch in diameter; neutral.

B_{21g}. 20 to 24 inches, dark-gray gritty silty clay with faint pale-yellow mottlings; structure aggregates are similar to those in the above horizon; neutral.

B_{22g}. 24 to 29 inches, mottled light-yellow, gray, and brown gritty silty clay of coarse to very coarse blocky structure; plastic when moist and hard when dry; mildly alkaline.

C. 29 to 42 inches, mottled light-gray, yellow, and brown smooth calcareous clay; breaks into blocky aggregates ½ to 2½ inches in diameter and shows a suggestion of vertical columnar structure.
C_2. 42 to 60 inches, light-gray smooth clay with faint yellow mottlings; structure is similar to that of the horizon above.
D_1. 60 to 114 inches, mottled pale-yellow, gray, and brown calcareous clay with thin seams and small pockets of fine sand.
D_2. 114 to 120 inches, yellow and brown calcareous very fine sandy clay with thin seams of fine sand.
D_3. 120 to 140 inches, light-gray smooth calcareous clay with seams and small pockets of very fine sand.
D_4. 140 inches +, gray smooth calcareous clay.

Maumee soils are very poorly drained and occupy depressions and broad flats in the Kankakee lacustrine section where natural drainage was once very poor. The water table was near or above the surface most of the time until the soils were artifically drained. The following is a profile description of Maumee fine sandy loam under a native marsh vegetation consisting of small quantities of bluegrass and marsh grass and a scattered growth of yellow and swamp willows in the southwest quarter of the northwest quarter of section 13, township 29 north, range 10 west:

A_{11}. 0 to 2 inches, very dark-gray to black fine sandy loam; organic content, 16.0 percent; contains a mass of roots; slightly acid.
A_{12}. 2 to 10 inches, very dark-gray fine sandy loam containing numerous roots; organic content, 6.4 percent; slightly acid.
A_{13}. 10 to 20 inches, dark-gray loose fine sandy loam containing a few small rust-brown specks; organic content, 4.0 percent; slightly acid.
B_{21g}. 20 to 31 inches, gray loose fine sand with a few small spots and stains of brown; dark organic material from the above horizon penetrates into this layer; neutral.
B_{22g}. 31 to 45 inches, loose gray fine sand with small streaks of dark-gray along old root channels; neutral.
C. 45 to 55 inches+, loose calcareous light-gray fine sand with small spots and pellets of sandy clay.

Maumee soils vary in thickness and texture of the different horizons and in the organic content of the surface soil and upper subsoil.

The Granby soils differ from the Maumee soils in being slightly less poorly drained, in having a lower content of organic matter in the surface soil, and in being mottled yellow and gray in the subsoil.

Dillon soils are highly acid but are otherwise comparable in profile characteristics to Maumee soils.

Newton soils are highly acid but differ from Dillon soils in being slightly less poorly drained, in having a lower content of organic matter in the surface soil, and in being highly mottled yellow and gray in the subsoil.

The Wabash soils are poorly drained, are developing from alluvium on the lower bottoms along the streams within the region of Prairie soils, and are associated with the Kaskaskia soil. They have very dark-gray to nearly black surface soil and mottled and dark underlying layers.

BOG SOILS

The Bog soils are the Houghton and Edwards. They consist of black or very dark brownish-gray muck over either a brown or brownish-yellow peaty and mucky material or a gray marl.

Houghton muck—the most extensive organic soil in the county—is derived almost entirely from an accumulation in place of reeds

and sedges. Little or no tree growth was present during its formation. The following describes a typical virgin profile of Houghton muck under an excellent stand of bluegrass in the southwest quarter of the southeast quarter of section 32, township 29 north, range 9 west:

1. 0 to 3 inches, black granular muck showing some evidence of platy structure; high concentration of roots; pH, 5.5.
2. 3 to 15 inches, black fluffy muck that breaks into chunks of irregular size and shape; chunks show thin depositional layers; contains some grass roots and a few distinguishable plant remains; pH, 5.5.
3. 15 to 23 inches, black compact muck that breaks into chunks 3 to 4 inches in diameter; pH, 5.5.
4. 23 to 32 inches, very dark brownish-gray soft mucky or peaty material containing a yellowish-brown mass of reed and sedge remains; breaks into horizontal plates ½ to 2 inches thick; pH, 5.5.
5. 32 to 44 inches, very dark-gray peaty and mucky material with a mass of dull brownish-yellow plant remains; breaks into distinct plates ½ to 2 inches thick; pH, 5.0.
6. 44 to 51 inches, pale olive-yellow organic material composed of easily distinguishable plant remains; material is soft and breaks out into thin plates; pH, 5.4.
7. 51 to 67 inches +, light olive-yellow organic matter consisting largely of plant remains and having a pronounced platy structure; some of the leaves and stems are olive green and the material as a whole is lighter colored than in the horizon above; pH, 5.6.

Houghton muck, shallow phase over sand, is composed of black muck to a depth of 15 to 30 inches. Below this is loose gray sand.

Edwards muck has a surface layer of black granular muck. At a depth of 10 to 36 inches this overlies gray calcareous marl containing numerous shells and fragments of partly decomposed sedges and reeds.

ALLUVIAL SOILS

The Alluvial soils—the Kaskaskia, and Griffin—are azonal and occur only along the flood plains of the rivers and streams. They constitute only a small proportion of the county.

Kaskaskia silt loam, the only Kaskaskia soil mapped in the county, is well drained and occurs on the flood plains of the Iroquois River and its tributaries where alluvial deposits are largely derived from soils of the upland and terrace grasslands. The very dark brownish-gray to dark-gray surface soil grades to brown at a depth of 24 to 36 inches. Little or no mottling has developed above a depth of 40 inches.

The Griffin soils are imperfectly drained and occupy the flood plains of the Kankakee River. They have conspicuous brown or yellow spots and streaks below a depth of 3 to 10 inches.

U. S. GOVERNMENT PRINTING OFFICE: 1958

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.

Accessibility Statement

This document is not accessible by screen-reader software. The U.S. Department of Agriculture is committed to making its electronic and information technologies accessible to individuals with disabilities by meeting or exceeding the requirements of Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended in 1998. Section 508 is a federal law that requires agencies to provide individuals with disabilities equal access to electronic information and data comparable to those who do not have disabilities, unless an undue burden would be imposed on the agency. The Section 508 standards are the technical requirements and criteria that are used to measure conformance within this law. More information on Section 508 and the technical standards can be found at www.section508.gov.

If you require assistance or wish to report an issue related to the accessibility of any content on this website, please email Section508@oc.usda.gov. If applicable, please include the web address or URL and the specific problems you have encountered. You may also contact a representative from the USDA Section 508 Coordination Team.

Nondiscrimination Statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the

Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at http://www.ascr.usda.gov/complaint_filing_cust.html and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by:

(1) mail: U.S. Department of Agriculture
Office of the Assistant Secretary for Civil Rights
1400 Independence Avenue, SW
Washington, D.C. 20250-9410;

(2) fax: (202) 690-7442; or

(3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

Soil	Map symbol	Physiography	Dominant slope	Soil drainage [1]	Surface runoff [2]	Internal drainage [1]	Underlying material	Color		Erodibility [3]	Workability
								Surface soil	Subsoil		
			Percent								
Ade fine sandy loam, undulating phase.	Aa	Uplands	2-5	Excessive	Low	Rapid	Loose noncalcareous sand.	Dark grayish brown to brownish gray.	Dark brown in upper part; brownish yellow in lower.	High (by wind)	Easy.
Ade loamy fine sand, undulating phase.	Ab	do	2-5	do	do	do	do	do	do	do	Easy, but sandy surface soil causes difficulty with some implements, especially tractors, which slip and get stuck.
Alida loamy fine sand	Ac	Outwash plain	0-2	Moderately good	Very low	Rapid to very rapid	do	Very dark gray to dark gray	Dark gray in upper part; mottled gray and yellow in lower.	do	Do.
Ayr fine sandy loam: Eroded undulating phase	Ad	Uplands	2-5	Somewhat excessive	Medium to low	Moderate to rapid	Loose noncalcareous sand over highly calcareous till.	Dark grayish brown to dark brownish gray.	Dark brown in upper part; brownish yellow in lower.	Moderate to high (by wind and water).	Easy.
Undulating phase	Ae	do	2-5	do	do	do	do	Dark brown to brown	do	do	Do.
Berrien loamy fine sand	Ba	Outwash plain	0-5	Moderately good	Very low	Rapid	Loose noncalcareous sand.	Grayish brown to brownish gray.	Pale yellow in upper part; mottled yellow and gray in lower.	High (by wind)	Easy, but sandy surface soil causes difficulty with some implements, especially tractors which slip and get stuck.
Severely wind-eroded phase	Bs	do	0-5	do	do	do	do	Pale yellow or brownish yellow.	do	do	Do.
Wind-eroded phase	Bc	do	0-5	do	do	do	do	do	do	do	Do.
Bridgman sand, wind-eroded undulating phase.	Bd	Beach ridges on lake plains.	0-5	Excessive	do	Very rapid	do	Light brownish gray to pale yellow.	Dark gray to dark brownish gray.	do	Do.
Chalmers loam	Ca	Uplands	0-2	Very poor	Very low to ponded	Slow	Highly calcareous light to moderately heavy glacial till.	Very dark gray to very dark brownish gray.	Dark gray in upper part; mottled gray, yellow, and brown in lower.	Low	Easy.
Chalmers silt loam	Cb	do	0-2	do	do	do	do	do	do	do	Moderate.
Chalmers silty clay loam	Cc	do	0-2	do	do	do	do	Very dark gray to nearly black.	do	do	Moderate to moderately difficult.
Clarence loam	Cd	do	1-3	Imperfect	Low to moderate	Slow to very slow	Very heavy-textured highly calcareous glacial till.	Dark gray to dark brownish gray.	do	do	Moderate.
Clarence silt loam	Ce	do	0-3	do	do	do	do	do	do	do	Moderate to moderately difficult.
Clyde silty clay loam	Cf	do	0-2	Very poor	Very low to ponded	Very slow	Medium to moderately heavy-textured highly calcareous glacial till.	Very dark gray to nearly black.	Very dark gray in upper part; gray faintly mottled with yellow in lower.	do	Do.
Coloma loamy fine sand: Undulating phase	Cg	do	0-5	Excessive	Very low to low	Very rapid	Light-textured (largely sand) noncalcareous glacial drift.	Grayish brown or yellowish brown.	Brownish yellow	High (by wind)	Easy; difficulty with some implements owing to sandy surface soil.
Wind-eroded undulating phase.	Ch	do	0-5	do	do	do	do	Yellowish brown or brownish yellow.	do	do	Do.
Conrad fine sand	Ck	Old lake beds	0-2	Very poor	Very low to ponded	Very slow	Loose calcareous sand	Dark gray or light gray	Alternate dark gray and light gray.	Low to moderate	Do.
Corwin loam	Cl	Uplands	0-2	Moderately good	Medium to low	Slow to moderate	Light-textured highly calcareous glacial till.	Dark grayish brown to dark brownish gray.	Dark brown in upper part; mottled gray, yellow, and brown in lower.	Low	Moderate.
Corwin silt loam	Cm	do	0-2	do	do	do	Light- to medium-textured highly calcareous glacial till.	do	Dark brownish gray to brownish yellow or pale yellow in upper part; mottled yellow, gray, and brown in lower.	do	Do.
Crosby silt loam	Cn	do	0-2	Imperfect	Low	Slow	Medium-textured highly calcareous glacial till.	Brownish gray	Mottled gray, yellow, and brown.	do	Do.
Darroch fine sandy loam	Da	Lake and outwash plains.	0-2	do	do	do	Calcareous stratified sand and silt with some clay.	Very dark brownish gray to very dark gray.	Dark brownish gray to very dark gray in upper part; mottled gray, yellow, and brown in lower.	Low to moderate (by wind).	Easy.
Darroch loam	Db	do	0-2	do	do	do	do	do	do	Low	Moderate.
Darroch silt loam	Dc	do	0-2	do	do	do	do	do	Dark to very dark brownish gray in upper part; mottled yellow, gray, and brown in lower.	do	Do.
Deardorff fine sandy loam	Dd	Uplands	0-2	Moderately good	do	Moderate to rapid	Noncalcareous sand over calcareous glacial till.	Dark grayish brown to dark brownish gray.	Dark to very dark gray in upper part; mottled yellow, gray, and brown in lower.	Moderate (by wind)	Easy, but sandy surface soil causes difficulty with some implements, especially tractors, which slip and get stuck.
Della silty clay loam	De	Lake and outwash plains.	0-2	Very poor	Very low to ponded	Slow	Stratified highly calcareous lake-laid clay, silt, and sand.	Very dark gray	Very dark gray in upper part; gray or gray, yellow, and brown in lower.	Low	Moderately difficult.
Dillon fine sandy loam	Df	Outwash and lake plains.	0-2	do	do	do	Noncalcareous loose sand.	do	Very dark gray in upper part; gray or light gray in lower.	do	Easy.
Dillon loamy fine sand	Dg	do	0-2	do	do	do	do	do	do	Low to moderate (by wind).	Do.
Edwards loamy muck	Ea	Outwash plains	0-2	do	do	Very slow to none	Highly calcareous gray marl.	Very dark gray to very dark brownish gray.	Very dark gray to very dark brownish gray.	Moderate to high (by wind).	Do.
Edwards muck	Eb	do	0-2	do	do	do	do	Brownish black to black.	Black, brownish black, or brown.	do	Do.
Burned phase	Ec	do	0-2	do	do	do	do	Reddish brown or yellow.	do	do	Do.
Foresman fine sandy loam	Fa	Lake and outwash plains.	0-2	Moderately good	Low	Moderate to slow	Stratified calcareous sand and silt with some clay.	Dark grayish brown to dark brownish gray.	Dark grayish brown to dark brownish gray in upper part; mottled yellow, gray, and brown in lower.	Low to moderate (by wind).	Do.
Foresman loam	Fb	do	0-2	do	do	do	do	Dark brownish gray to very dark brownish gray.	do	Low	Moderate.
Foresman silt loam	Fc	do	0-2	do	do	do	do	Dark grayish brown to very dark grayish brown.	do	do	Do.
Granby fine sandy loam	Ga	Outwash and lake plains.	0-2	Very poor	Very low to ponded	Very slow	Loose calcareous sand	Very dark gray to very dark brownish gray.	Dark gray in upper part; mottled gray and yellow in lower.	Low to moderate (by wind).	Easy.
Mucky subsoil phase	Gs	do	0-2	do	do	do	do	Very dark gray	do	do	Do.
Granby loamy fine sand	Ge	do	0-2	do	do	do	do	Very dark gray to very dark brownish gray.	do	do	Do.
Gravel and sand pits		Lake and outwash plains.					Variable.				
Griffin fine sandy loam	Gb	Flood plains	0-2	Imperfect	Low to very low	Slow	Stratified layers of sand and silt; neutral to calcareous.	Medium dark gray with faint yellowish hue.	Yellowish gray mottled and blotched with yellow and brown.	Low	Easy.
Griffin loam	Gc	do	0-2	do	do	do	do	do	do	do	Do.
Griffin loamy fine sand	Gr	do	0-2	do	do	do	do	Brownish gray with yellow blotching and mottling.	Gray highly blotched and mottled with yellow and brown.	Low to moderate (by wind).	Do.
Hagener fine sandy loam, undulating phase.	Ha	Lake and outwash plains.	0-5	Excessive	Very low	Very rapid	Noncalcareous loose sand.	Dark grayish brown to dark brownish gray.	Dark brown to dark grayish brown in upper part; brownish yellow in lower.	High (by wind)	Easy, but sandy surface soil causes difficulty with some implements, especially tractors, which slip and get stuck.
Hagener loamy fine sand: Undulating phase	Hb	do	0-5	do	do	do	do	Dark brownish gray to very dark grayish brown.	Yellowish brown or brownish yellow.	do	Do.
Wind-eroded rolling phase	Hc	do	5-12	do	do	do	do	Dark grayish brown to brownish yellow.	Dark brown in upper part; yellowish brown or brownish yellow in lower.	do	Moderate to difficult because of slope and sandy surface and subsoil.
Houghton loamy muck over sand.	Hb	Outwash and lake plains.	0-2	Very poor	Very low to ponded	Very slow to none	Loose calcareous sand	Very dark brownish gray to black.	Very dark gray	Moderate to high (by wind).	Easy.
Houghton muck	Hs	do	0-2	do	do	do	Peaty material over loose calcareous sand.	Black to brownish black.	Very dark gray to brown in upper part; yellow to brownish yellow in lower.	do	Do.
Burned phase over sand	Hr	do	0-2	do	do	do	Loose calcareous sand	Reddish brown or yellow.	do	Low to moderate (by wind).	Do.
Shallow phase over sand	Ho	do	0-2	do	do	do	do	Black to brownish black.	Very dark gray to brown in upper part; gray and pale yellow in lower.	Moderate to high (by wind).	Do.
Jasper fine sandy loam: Eroded sloping phase	Ja	Lake and outwash plains.	5-12	Good	Medium to high	Moderate	Calcareous stratified sand and silt with some clay.	Dark grayish brown to dark brown.	Dark grayish brown to dark brown in upper part; brown or yellowish brown in lower.	Moderate to high	Do.
Undulating phase	Jb	do	2-5	do	Medium	do	do	Dark grayish brown	do	do	Do.
Jasper loam: Eroded sloping phase	Jc	do	5-8	do	Medium to high	do	do	Dark grayish brown to brownish yellow.	Dark grayish brown or yellowish brown in upper part; brown or yellowish brown in lower.	do	Moderate to easy.
Eroded undulating phase	Jo	do	2-5	do	Medium	do	do	do	do	do	Do.
Undulating phase	Je	do	2-5	do	do	do	do	Dark grayish brown	do	do	Do.
Jasper silt loam: Eroded sloping phase	Jr	do	5-12	do	Medium to high	do	do	Dark brown to yellowish brown.	Dark grayish brown to dark brown in upper part; brown or yellowish brown in lower.	do	Moderate.
Eroded undulating phase	Jn	do	2-5	do	Medium	do	do	do	do	do	Do.
Undulating phase	Jt	do	2-5	do	do	do	do	Dark brownish gray to dark grayish brown.	do	do	Do.
Julian silty clay loam	Jx	Lake plains	0-2	Very poor	Very low to ponded	Very slow to none	Highly calcareous clay.	Very dark gray to nearly black.	Very dark gray in upper part; mottled gray, yellow, and brown in lower.	Low	Moderately difficult to difficult.
Kaskaskia silt loam	Ka	Flood plains	0-2	Good	Low to medium	Moderate	Stratified silt and clay alluvium; neutral to calcareous.	Dark grayish brown to dark brownish gray.	Dark grayish brown to brown.	do	Moderate.
Kibbie loam	Kb	Lake and outwash plains.	0-2	Imperfect	Low	Slow	Calcareous stratified sand and silt with some clay.	Brownish gray to light brownish gray.	Mottled gray, yellow, and brown.	do	Do.
Kibbie silt loam	Kc	do	0-2	do	do	do	do	do	do	do	Do.
Maumee fine sandy loam	Ma	Outwash and lake plains.	0-2	Very poor	Very low to ponded	Very slow to none	Loose calcareous sand	Very dark gray to nearly black.	Very dark gray to dark gray in upper part; light gray with yellow and brown mottlings in lower.	Low to moderate (by wind).	Easy.
Ferruginous phase	Mb	do	0-2	do	do	do	do	Yellow to dark yellowish brown.	do	do	Do.
Mucky subsoil phase	Mc	do	0-2	do	do	do	do	Very dark gray	Very dark gray to very dark brownish gray in upper part; mottled gray and pale yellow in lower.	do	Do.
Maumee loam	Mb	do	0 2	do	do	do	do	do	Very dark gray to dark gray in upper part; gray with yellow and brown mottlings in lower.	do	Do.
Maumee loamy fine sand	Me	do	0-2	do	do	do	do	do	do	Moderate	Do.
Miami silt loam: Eroded sloping phase	Mr	Uplands	5-8	Good	Medium to high	Moderate	Light- to medium-textured highly calcareous glacial till.	Yellowish brown to brownish yellow.	Yellowish brown to brownish yellow.	Moderate to high	Moderate to moderately difficult.
Eroded undulating phase	Mo	do	2-5	do	Medium	do	do	do	do	do	Moderate.
Moderately steep phase	Mu	do	12-20	Somewhat excessive	High	do	do	Grayish brown to yellowish brown.	do	High	Difficult because of slope.
Undulating phase	Mz	do	2-5	do	Medium	do	do	do	do	Moderate to high	Moderate.
Morocco fine sandy loam	Ml	Outwash and lake plains.	0-2	Imperfect	Very low	Slow	Noncalcareous loose sand.	Light brownish gray	Mottled gray and yellow	Moderate to high (by wind).	Easy.
Morocco loamy fine sand	Mm	do	0-2	do	do	do	do	do	do	do	Do.
Newton fine sandy loam	Na	do	0-2	Very poor	Very low to ponded	Very slow	do	Very dark gray to dark gray	Dark gray in upper part; mottled yellow and gray in lower.	Low to moderate (by wind).	Do.
Newton loamy fine sand	Nn	do	0-2	do	do	do	do	do	do	do	Do.
Odell loam	Oa	Uplands	0-2	Imperfect	Low	Slow	Light-textured highly calcareous glacial till.	Dark gray to very dark brownish gray.	Dark brownish gray in upper part; mottled gray, yellow, and brown in lower.	Low	Easy to moderate.
Odell silt loam	Ob	do	0-2	do	do	do	Light- to medium-textured highly calcareous glacial till.	do	Dark gray to very dark gray in upper part; mottled gray, yellow, and brown in lower.	do	Moderate.
Parr fine sandy loam, undulating phase.	Pa	do	2-5	Good	Medium	Moderate	Light-textured highly calcareous glacial till.	Dark grayish brown to dark brown.	Dark brown in upper part; yellowish brown in lower.	Moderate to high	Easy.
Parr loam: Eroded sloping phase	Pb	do	5-8	do	Medium to high	do	Light- to medium-textured highly calcareous glacial till.	Dark brown to yellowish brown.	Yellowish brown	do	Easy to moderate.
Eroded undulating phase	Pc	do	2-5	do	Medium	do	do	do	do	do	Do.
Severely eroded undulating phase.	Pb	do	2-5	do	do	do	do	Yellowish brown to brown.	do	High	Do.
Undulating phase	Pe	do	2-5	do	do	do	do	Dark grayish brown to very dark grayish brown.	do	Moderate to high	Do.
Parr silt loam: Eroded moderately steep phase.	Pr	do	10-12+	Good to somewhat excessive.	High	do	do	Yellowish brown to dark brown.	do	High	Moderately difficult because of slope.
Eroded sloping phase	Po	do	5-8	Moderate to high	do	do	do	do	do	do	Moderate to moderately difficult.
Eroded undulating phase	Pn	do	2-5	Good	Medium	do	do	do	do	Moderate to high	Moderate.
Undulating phase	Px	do	2-5	do	do	do	do	Dark grayish brown	Dark brown in upper part; brown in lower.	do	Do.
Plainfield fine sand: Rolling phase	Ps	Outwash plains	5-12	Excessive	Very low	Very rapid	Noncalcareous loose sand.	Light grayish brown to brownish yellow.	Brownish yellow	High (by wind)	Moderate to difficult because of slope and sandy surface soil and subsoil.
Severely wind-eroded rolling phase.	Pm	do	5-12	do	do	do	do	Brownish yellow	do	do	Do.
Severely wind-eroded undulating phase.	Pn	do	0-5	do	do	do	do	do	do	do	Easy, but sandy surface soil causes difficulty with some implements, especially tractors, which slip and get stuck.
Undulating phase	Po	do	0-5	do	do	do	do	Light grayish brown or yellowish brown.	do	do	Do.
Wind-eroded rolling phase	Pr	do	5-12	do	do	do	do	Yellowish brown or brownish yellow.	do	do	Moderate to difficult because of slope and sandy surface and subsoil.
Wind-eroded undulating phase	Pa	do	0-5	do	do	do	do	do	do	do	Easy; difficulty with some implements owing to sandy surface and subsoil.
Rensselaer loam	Ra	Lake and outwash plains.	0-2	Very poor	Very low to ponded	Very slow	Calcareous stratified sand and silt with some clay.	Very dark gray	Very dark gray to dark gray in upper part; mottled gray, yellow, and brown in lower.	Low	Moderate.
Rensselaer silt loam	Rb	do	0-2	do	do	do	do	do	do	do	Do.
Rensselaer silty clay loam	Rc	do	0-2	do	do	do	do	do	do	do	Moderate to moderately difficult.
Stockwell loam: Eroded sloping phase	Sa	Uplands	5-12	Good to somewhat excessive.	Medium to low	Moderate to rapid	Highly calcareous stratified gravel.	Dark grayish brown to yellowish brown.	Brown in upper part; dark grayish brown to very dark brown in lower.	Moderate to high	Moderate.
Undulating phase	Sb	do	2-5	do	do	do	do	Dark grayish brown to dark brown.	do	Moderate	Easy.
Strole loam	Sc	Lake and outwash plains.	0-2	Imperfect	Low	Slow	Highly calcareous lake-laid clay.	Very dark brownish gray to very dark gray.	Dark gray in upper part; mottled gray, yellow, and brown in lower.	Low	Moderate.
Strole silt loam	Sb	do	0-2	do	do	do	do	Dark brownish gray to very dark brownish gray.	do	do	Moderate to moderately difficult.
Swygert loam	Sn	Uplands	1-3	Moderately good	Medium	Slow	Heavy-textured highly calcareous glacial till.	Dark gray to dark brownish gray.	Dark gray to dark brownish gray in upper part; mottled brown, gray, and yellow in lower.	do	Do.
Swygert silt loam	Sr	do	1-3	do	do	do	do	do	do	do	Do.
Tippecanoe loam	Ta	Outwash plains	0-2	Low to very low	Moderate to somewhat slow	Calcareous stratified gravel and coarse sands.	Dark grayish brown to dark brownish gray.	Brown in upper part; mottled gray, yellow, and brown in lower.	do	Easy.
Tuscola loam, undulating phase.	Tb	do	2-5	Good	Medium	Moderate	Calcareous stratified sand and silt with some clay.	Grayish brown to yellowish brown.	Brown or yellowish brown	Moderate	Do.
Tuscola silt loam: Eroded undulating phase	Tc	do	2-5	do	do	do	do	Brown	do	do	Moderate.
Moderately steep phase	Td	do	12-20	Good to somewhat excessive.	High	do	do	Grayish brown to yellowish brown.	do	High	Difficult because of slope.
Wabash silt loam	Wa	Flood plains	0-2	Imperfect	Low	Slow	Neutral to calcareous alluvium of silt and clay.	Very dark gray	Very dark gray in upper part; mottled gray, yellow, and brown in lower.	Low	Moderate.
Wabash silty clay loam	Wa	do	0-2	Moderately good to imperfect.	do	do	do	do	do	do	Moderately difficult to difficult.
Weiss fine sand	Wc	Outwash and lake plains.	0-2	Imperfect	Very low	do	Calcareous sand	Brownish gray	Mottled gray and yellow	High (by wind)	Easy, but sandy surface soil causes difficulty with some implements, especially tractors which slip and get stuck.
Wind-eroded phase	Wb	do	0-2	do	do	do	do	Brownish gray to mottled gray and yellow.	do	do	Do.
Wooten fine sand	Wn	Lake plains	0-2	do	do	do	Neutral to calcareous sand with thin layers of peaty material.	Dark gray to pale yellow.	Dark gray with layers of light gray and dark brown.	do	Do.
Wind-eroded phase	Wr	do	0-2	do	do	do	do	Pale yellow to mottled gray and yellow.	do	do	Do.

[1] Drainage conditions existing during development of the soil; present drainage conditions have in many instances been altered by artificial drainage.

[2] The quantity of water removed by flow over the surface of the soil; terms used are relative.

[3] The movement of water through the soil profile; rate of movement affected by the texture of the surface and subsoil and by the height of the ground water table; terms used are relative; degree, or rate, of internal drainage is in many places altered by drainage and by lowering the water table.

[4] Susceptibility of a soil to erosion when under cultivation or without adequate vegetative cover.

SOIL MAP
NEWTON COUNTY, INDIANA
SOUTHERN SHEET

PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

AGRICULTURE
SERVICE

Map constructed by Cartographic Division, Soil Conservation Service, in cooperation with Department of Agronomy, Purdue University. Planimetry compiled from aerial photographs by photogrammetric methods. Horizontal control from USGS and National surveys. Projection: Indiana coordinate system, West zone (Transverse Mercator). Polyconic projection. 1927 North American datum. 10,000 foot grid based on Indiana (West) rectangular coordinate system.

Scale 1:31,680

1 mile, 1/2, 0, 1, 2 Miles
5 000, 0, 5 000, 10 000 Feet

Prepared by Soil Conservation Service, U.S. Department of Agriculture, in cooperation with Purdue Agricultural Experiment Station, Soils Section.

LEGEND

SOILS WITH GENTLE SLOPES

EXCESSIVELY DRAINED DARK-COLORED SANDY SOILS

- Ade fine sandy loam, undulating phase
- Ade loamy fine sand, undulating phase
- Ade loamy fine sand, rolling phase
- Ade silty clay loam
- Aubbeenaubee loamy fine sand, undulating phase
- Aubbeenaubee loamy fine sand, rolling phase
- Aubbeenaubee loamy fine sand, severely wind-eroded phase
- Aubbeenaubee loamy fine sand, severely wind-eroded rolling phase
- Aubbeenaubee loamy fine sand, undulating phase
- Aubbeenaubee loamy fine sand, rolling phase
- Aubbeenaubee loamy fine sand, severely wind-eroded phase
- Aubbeenaubee loamy fine sand, severely wind-eroded rolling phase
- Aubbeenaubee silty clay loam
- Dutch silty clay loam
- Jubun silty clay loam
- Lamont silt loam
- Lamont loam
- Lamont fine sandy loam
- Lamont silt loam
- Lamont silty clay loam
- Oshtemo silt loam
- Oshtemo loamy fine sand
- Oshtemo loamy fine sand, severely wind-eroded phase
- Oshtemo loamy fine sand, severely wind-eroded rolling phase
- Oshtemo fine sandy loam
- Oshtemo silt loam
- Oshtemo silty clay loam
- Tuscola silt loam
- Tuscola silt loam, severely wind-eroded phase
- Tuscola silt loam, severely wind-eroded rolling phase
- Tuscola silt loam, undulating phase
- Tuscola silt loam, undulating rolling phase
- Tuscola silt loam, moderately steep phase (12-20 percent slope)
- Typic Argiaquolls and Typic Haplaquolls, nearly level
- Typic Haplaquolls, nearly level
- Typic Haplaquolls, undulating phase
- Typic Haplaquolls, undulating rolling phase
- Typic Haplaquolls, severely wind-eroded phase
- Typic Haplaquolls, severely wind-eroded rolling phase
- Typic Haplaquolls, undulating phase
- Typic Haplaquolls, undulating rolling phase
- Typic Haplaquolls, severely wind-eroded phase
- Typic Haplaquolls, severely wind-eroded rolling phase
- Typic Haplaquolls, moderately steep phase (12-20 percent slope)

SOILS WITH MODERATE TO FAIRLY STEEP SLOPES

MODERATELY WELL-TO IMPERFECTLY DRAINED SANDY SOILS OVER LOOSE SANDS

- Adrian loamy fine sand
- Emmert loamy fine sand, severely wind-eroded phase
- Emmert loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand
- Maxinkuckee loamy fine sand, severely wind-eroded phase
- Maxinkuckee loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand, undulating phase
- Maxinkuckee loamy fine sand, undulating rolling phase
- Maxinkuckee loamy fine sand, severely wind-eroded phase
- Maxinkuckee loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand, moderately steep phase (12-20 percent slope)
- Rensselaer loam
- Rensselaer loam, undulating phase
- Rensselaer loam, undulating rolling phase
- Rensselaer loam, severely wind-eroded phase
- Rensselaer loam, severely wind-eroded rolling phase
- Rensselaer loam, undulating phase
- Rensselaer loam, undulating rolling phase
- Rensselaer loam, severely wind-eroded phase
- Rensselaer loam, severely wind-eroded rolling phase
- Rensselaer loam, moderately steep phase (12-20 percent slope)

MODERATELY WELL-TO IMPERFECTLY DRAINED SANDY SOILS OVER LOOSE SANDS

- Adrian loamy fine sand
- Emmert loamy fine sand, severely wind-eroded phase
- Maxinkuckee loamy fine sand
- Maxinkuckee loamy fine sand, severely wind-eroded phase

POORLY DRAINED LIGHT-COLORED SANDS

- Brookston loamy fine sand, undulating phase
- Brookston loamy fine sand, undulating rolling phase
- Brookston loamy fine sand, severely wind-eroded phase
- Brookston loamy fine sand, severely wind-eroded rolling phase
- Brookston loamy fine sand, undulating phase
- Brookston loamy fine sand, undulating rolling phase
- Brookston loamy fine sand, severely wind-eroded phase
- Brookston loamy fine sand, severely wind-eroded rolling phase
- Brookston loamy fine sand, moderately steep phase (12-20 percent slope)

BURIED MUCK AND IMPERFECTLY TO POORLY DRAINED SANDS OF LOW PRODUCTIVITY

- Channahon fine sand
- Channahon muck, burned phase
- Channahon fine sand, gravelly phase
- Houghton muck, burned phase over sand
- Houghton muck, burned phase over gravel and cobbles
- Maxinkuckee loamy fine sand, undulating phase
- Maxinkuckee loamy fine sand, undulating rolling phase
- Wococo fine sandy loam
- Wococo loamy fine sand
- Wococo loamy fine sand, severely wind-eroded phase

VERY POORLY DRAINED DARK SANDY SOILS (SLIGHTLY ACID TO NEUTRAL)

- Granby fine sandy loam
- Granby fine sandy loam, mucky subsoil phase
- Kalmarse fine sandy loam
- Kalmarse fine sandy loam, mucky subsoil phase
- Kalmarse loamy fine sand
- Kalmarse loamy fine sand, shallow phase
- Kalmarse loamy fine sand, mucky subsoil phase

VERY POORLY DRAINED DARK SANDY SOILS (STRONGLY ACID)

- Gilson fine sandy loam
- Gilson loamy fine sand
- Newton fine sandy loam
- Newton loamy fine sand
- Rensselaer loamy fine sand
- Rensselaer loamy fine sand, severely wind-eroded phase

ALLUVIAL SOILS

- Chenoa fine sandy loam
- Chenoa silt loam
- Kankakee silt loam
- Wabash silt loam
- Wabash silty clay loam

ORGANIC SOILS

- Edwards loamy muck
- Houghton loamy muck over sand
- Houghton muck
- Houghton muck, shallow phase over sand

MISCELLANEOUS

- Alluvial land
- Beaches
- Borrow pits
- Dumps
- Gravel and sand pits
- Made land
- Marsh
- Rock outcrop
- Sand dunes
- Sandy land
- Steep gullied land
- Stony, loamy and clayey land
- Stony, loamy and clayey land, steep phase
- Stony, loamy and clayey land, very steep phase
- Stony, loamy and clayey land, severely wind-eroded phase
- Stony, loamy and clayey land, severely wind-eroded rolling phase
- Stony, loamy and clayey land, moderately steep phase (12-20 percent slope)
- Stony, loamy and clayey land, undulating phase
- Stony, loamy and clayey land, undulating rolling phase
- Stony, loamy and clayey land, severely wind-eroded phase
- Stony, loamy and clayey land, severely wind-eroded rolling phase
- Stony, loamy and clayey land, moderately steep phase (12-20 percent slope)
- Stony, loamy and clayey land, undulating phase
- Stony, loamy and clayey land, undulating rolling phase
- Stony, loamy and clayey land, severely wind-eroded phase
- Stony, loamy and clayey land, severely wind-eroded rolling phase
- Stony, loamy and clayey land, moderately steep phase (12-20 percent slope)
- Swamp
- Tallott silt loam
- Water

IMPERFECTLY AND VERY POORLY DRAINED DARK-COLORED MEDIUM TO FINE TEXTURED SOILS

- Clunette silt loam
- Clunette silty clay loam
- Clyde loam
- Clyde silty clay loam
- Dana silty clay loam
- Dunbarton silt loam
- Dunbarton silty clay loam
- Fincastle silt loam
- Fincastle silty clay loam
- Hoopeston fine sandy loam
- Hoopeston loam
- Hoopeston silt loam
- Hoopeston silty clay loam
- Millbrook silt loam
- Millbrook silty clay loam
- Pinhook silt loam
- Pinhook silty clay loam
- Raub silt loam
- Raub silty clay loam
- Rockfield silt loam
- Rockfield silty clay loam
- Sebewa loam
- Sebewa silty clay loam
- Shoals silt loam
- Shoals silty clay loam
- Sloan loam
- Sloan silty clay loam
- Starks loam
- Starks silty clay loam
- Stonelick loam
- Stonelick silty clay loam
- Wea loam
- Wea silty clay loam
- Whitaker loam
- Whitaker silty clay loam

SOILS WITH MODERATELY SLOPING PHASES

- Clunette silt loam, undulating phase
- Clunette silty clay loam, undulating phase
- Clyde silt loam, undulating phase
- Clyde silty clay loam, undulating phase
- Fincastle silt loam, undulating phase
- Fincastle silty clay loam, undulating phase
- Hoopeston fine sandy loam, undulating phase
- Hoopeston loam, undulating phase
- Hoopeston silt loam, undulating phase
- Hoopeston silty clay loam, undulating phase
- Millbrook silt loam, undulating phase
- Millbrook silty clay loam, undulating phase
- Pinhook silt loam, undulating phase
- Pinhook silty clay loam, undulating phase
- Raub silt loam, undulating phase
- Raub silty clay loam, undulating phase
- Rockfield silt loam, undulating phase
- Rockfield silty clay loam, undulating phase
- Sebewa loam, undulating phase
- Sebewa silty clay loam, undulating phase
- Shoals silt loam, undulating phase
- Shoals silty clay loam, undulating phase
- Starks loam, undulating phase
- Starks silty clay loam, undulating phase
- Stonelick loam, undulating phase
- Stonelick silty clay loam, undulating phase
- Wea loam, undulating phase
- Wea silty clay loam, undulating phase
- Whitaker loam, undulating phase
- Whitaker silty clay loam, undulating phase

SOILS WITH STEEP SLOPES

- Clunette silt loam, undulating rolling phase
- Clunette silty clay loam, undulating rolling phase
- Clyde silt loam, undulating rolling phase
- Clyde silty clay loam, undulating rolling phase
- Fincastle silt loam, undulating rolling phase
- Fincastle silty clay loam, undulating rolling phase
- Hoopeston fine sandy loam, undulating rolling phase
- Hoopeston loam, undulating rolling phase
- Hoopeston silt loam, undulating rolling phase
- Hoopeston silty clay loam, undulating rolling phase
- Millbrook silt loam, undulating rolling phase
- Millbrook silty clay loam, undulating rolling phase
- Pinhook silt loam, undulating rolling phase
- Pinhook silty clay loam, undulating rolling phase
- Raub silt loam, undulating rolling phase
- Raub silty clay loam, undulating rolling phase
- Rockfield silt loam, undulating rolling phase
- Rockfield silty clay loam, undulating rolling phase
- Sebewa loam, undulating rolling phase
- Sebewa silty clay loam, undulating rolling phase
- Shoals silt loam, undulating rolling phase
- Shoals silty clay loam, undulating rolling phase
- Starks loam, undulating rolling phase
- Starks silty clay loam, undulating rolling phase
- Stonelick loam, undulating rolling phase
- Stonelick silty clay loam, undulating rolling phase
- Wea loam, undulating rolling phase
- Wea silty clay loam, undulating rolling phase
- Whitaker loam, undulating rolling phase
- Whitaker silty clay loam, undulating rolling phase

SOILS WITH MODERATELY STEEP SLOPES

- Clunette silt loam, moderately steep phase (12-20 percent slope)
- Clunette silty clay loam, moderately steep phase (12-20 percent slope)
- Clyde silt loam, moderately steep phase (12-20 percent slope)
- Clyde silty clay loam, moderately steep phase (12-20 percent slope)
- Fincastle silt loam, moderately steep phase (12-20 percent slope)
- Fincastle silty clay loam, moderately steep phase (12-20 percent slope)
- Hoopeston fine sandy loam, moderately steep phase (12-20 percent slope)
- Hoopeston loam, moderately steep phase (12-20 percent slope)
- Hoopeston silt loam, moderately steep phase (12-20 percent slope)
- Hoopeston silty clay loam, moderately steep phase (12-20 percent slope)
- Millbrook silt loam, moderately steep phase (12-20 percent slope)
- Millbrook silty clay loam, moderately steep phase (12-20 percent slope)
- Pinhook silt loam, moderately steep phase (12-20 percent slope)
- Pinhook silty clay loam, moderately steep phase (12-20 percent slope)
- Raub silt loam, moderately steep phase (12-20 percent slope)
- Raub silty clay loam, moderately steep phase (12-20 percent slope)
- Rockfield silt loam, moderately steep phase (12-20 percent slope)
- Rockfield silty clay loam, moderately steep phase (12-20 percent slope)
- Sebewa loam, moderately steep phase (12-20 percent slope)
- Sebewa silty clay loam, moderately steep phase (12-20 percent slope)
- Shoals silt loam, moderately steep phase (12-20 percent slope)
- Shoals silty clay loam, moderately steep phase (12-20 percent slope)
- Starks loam, moderately steep phase (12-20 percent slope)
- Starks silty clay loam, moderately steep phase (12-20 percent slope)
- Stonelick loam, moderately steep phase (12-20 percent slope)
- Stonelick silty clay loam, moderately steep phase (12-20 percent slope)
- Wea loam, moderately steep phase (12-20 percent slope)
- Wea silty clay loam, moderately steep phase (12-20 percent slope)
- Whitaker loam, moderately steep phase (12-20 percent slope)
- Whitaker silty clay loam, moderately steep phase (12-20 percent slope)

COLOR GROUPING

SOILS WITH MODERATE TO FAIRLY STEEP SLOPES

- Majenor loamy fine sand, wind-eroded rolling phase
- Jasper loamy fine sand, undulating phase
- Jasper fine sandy loam, undulating phase
- Jasper silt loam, eroded sloping phase
- Warm silt loam, eroded sloping phase
- Warm silt loam, moderately steep phase
- Rifle silt loam, eroded sloping phase
- Rifle silt loam, moderately steep phase
- Gosport fine sandy loam, undulating phase
- Gosport fine sandy loam, undulating rolling phase
- Gosport fine sandy loam, severely wind-eroded phase
- Gosport fine sandy loam, severely wind-eroded rolling phase
- Tuscola silt loam, moderately steep phase
- Tuscola silt loam, mottled undulating phase

EXCESSIVELY DRAINED DARK-COLORED SANDY SOILS

- Ade fine sandy loam, undulating phase
- Ade loamy fine sand, undulating phase
- Majenor loamy fine sand, undulating phase

SOILS WITH GENTLE SLOPES

- Majenor loamy fine sand, wind-eroded rolling phase
- Jasper fine sandy loam, wind-eroded sloping phase
- Jasper silt loam, eroded sloping phase
- Warm silt loam, eroded sloping phase
- Rifle silt loam, moderately steep phase
- Rifle silt loam, eroded sloping phase
- Gosport fine sandy loam, undulating phase
- Tuscola silt loam, mottled undulating phase

IMPERFECTLY AND VERY POORLY DRAINED DARK-COLORED MEDIUM TO FINE TEXTURED SOILS

- Clunette silt loam
- Clunette silty clay loam
- Clyde silt loam
- Clyde silty clay loam
- Lamont silt loam
- Lamont loam
- Lamont fine sandy loam
- Lamont silt loam
- Oshtemo silty clay loam
- Oshtemo silt loam
- Rensselaer silty clay loam
- Rensselaer silt loam
- Shoals silt loam
- Shoals silty clay loam
- Starks loam
- Starks silt loam

MODERATELY WELL-TO IMPERFECTLY DRAINED SANDY SOILS OVER LOOSE SANDS

- Adrian loamy fine sand
- Emmert loamy fine sand, severely wind-eroded phase
- Emmert loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand
- Maxinkuckee loamy fine sand, severely wind-eroded phase
- Maxinkuckee loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand, undulating phase
- Maxinkuckee loamy fine sand, undulating rolling phase
- Maxinkuckee loamy fine sand, severely wind-eroded phase
- Maxinkuckee loamy fine sand, severely wind-eroded rolling phase
- Maxinkuckee loamy fine sand, moderately steep phase (12-20 percent slope)
- Typic Haplaquolls and Typic Argiaquolls, nearly level
- Typic Haplaquolls, nearly level
- Typic Haplaquolls, undulating phase
- Typic Haplaquolls, undulating rolling phase
- Typic Haplaquolls, severely wind-eroded phase
- Typic Haplaquolls, severely wind-eroded rolling phase
- Typic Haplaquolls, undulating phase
- Typic Haplaquolls, undulating rolling phase
- Typic Haplaquolls, severely wind-eroded phase
- Typic Haplaquolls, severely wind-eroded rolling phase
- Typic Haplaquolls, moderately steep phase (12-20 percent slope)

CONVENTIONAL SIGNS

CULTURE

- Cities or Villages, Roads, Railroads, Wharves, Ferries, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Steam and Electric
- Bridges, Ferry
- R.R. crossing, Tunnel
- Forest, Dam, Sawmill, Windmill
- Boundary lines
- Intermittent drainage, Wells, Springs, Watering wells
- Lakes, Ponds, Intermittent lakes
- Canal
- Ditches
- Cross fences
- Levees
- Buildings
- School, Church, Cemetery, Cemeteries
- Monuments, Markers
- Boundary lines
- Bloomfield
- Boundary monument
- Oil or Gas wells
- U.S. Township and Section lines
- Recovered corners
- Forest fire station
- Oil or Gas pipe line
- Transmission line
- Gravel or sand pits
- Rock outcrop
- Soil boundaries, Stony, Gravelly and Chert areas

RELIEF

- Contours
- Depression contours
- Mountain Hills
- Prominent Mountain peaks
- Sand, Wash, and Sand dunes
- Bluff, Escarpment, Mine dumps

DRAINAGE

(Printed in blue)

- Streams, Springs, Wells, Rising wells
- Intermittent drainage, Wet crossable with farm machinery
- Crossable with farm machinery
- Swamp
- Submerged marsh
- Tidal flats

The above signs are reversed when they occur on the red maps. Variations may occur in minor details of earlier dates.

SOIL MAP
NEWTON COUNTY-INDIANA
NORTHERN SHEET

PURDUE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION

Map constructed by Cartographic Division, Soil Conservation Service, in cooperation with Department of Agronomy, Purdue University.
Planimetry compiled from aerial photographs by photogrammetric methods.
Horizontal control from USGS and related surveys.
Polyconic projection. 1927 North American datum.
10 000 foot grid based on Indiana (West) rectangular coordinate system.

Scale 1:31,680

1 0 1 2 Miles
5 000 0 5 000 10 000 Feet

LEGEND

Ad	Fine sandy loam, undulating phase (2-5 percent slope)	Ha	Fine sandy loam (0-2 percent slope)
Ae	Fine sandy loam, undulating phase (5-8 percent slope)	Hb	Fine sandy loam, undulating phase (0-2 percent slope)
Af	Fine sandy loam, eroded undulating phase (2-5 percent slope)	Hc	Fine sandy loam, undulating phase (5-12 percent slope)
Ag	Fine sandy loam, eroded undulating phase (5-8 percent slope)	Hd	Houghton muck (0-2 percent slope)
Ah	Fine sandy loam, eroded rolling phase (5-12 percent slope)	He	Houghton muck (0-2 percent slope)
Ak	Alida loamy fine sand (0-2 percent slope)	Hf	Houghton muck, burned phase (0-2 percent slope)
Ar	Ade loamy fine sand, undulating phase (2-5 percent slope)	Hg	Houghton muck, shallow phase over sand (0-2 percent slope)
As	Ade loamy fine sand, undulating phase (5-8 percent slope)	Ia	Jasper fine sandy loam (0-2 percent slope)
At	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ib	Jasper fine sandy loam, undulating phase (2-5 percent slope)
Au	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ic	Jasper fine sandy loam, undulating phase (5-8 percent slope)
Av	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Id	Jasper fine sandy loam, undulating phase (8-12 percent slope)
Aw	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ie	Jasper fine sandy loam, eroded undulating phase (2-5 percent slope)
Ax	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	If	Jasper fine sandy loam, eroded undulating phase (5-8 percent slope)
Ay	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ig	Jasper fine sandy loam, eroded undulating phase (8-12 percent slope)
Az	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ih	Jasper fine sandy loam, eroded undulating phase (12-20 percent slope)
Ba	Ade loamy fine sand, eroded undulating phase (5-8 percent slope)	Ja	Jasper fine sandy loam, mucky subsoil phase (0-2 percent slope)
Bb	Ade loamy fine sand, eroded undulating phase (8-12 percent slope)	Jb	Jasper fine sandy loam, mucky subsoil phase (2-5 percent slope)
Bc	Ade loamy fine sand, eroded undulating phase (12-20 percent slope)	Jc	Jasper fine sandy loam, mucky subsoil phase (5-8 percent slope)
Bd	Ade loamy fine sand, eroded undulating phase (20-30 percent slope)	Jd	Jasper fine sandy loam, mucky subsoil phase (8-12 percent slope)
Be	Ade loamy fine sand, eroded undulating phase (30-40 percent slope)	Je	Jasper fine sandy loam, mucky subsoil phase (12-20 percent slope)
Bf	Ade loamy fine sand, eroded undulating phase (40-50 percent slope)	Jf	Jasper fine sandy loam, mucky subsoil phase (20-30 percent slope)
Bg	Ade loamy fine sand, eroded undulating phase (50-60 percent slope)	Jg	Jasper fine sandy loam, mucky subsoil phase (30-40 percent slope)
Bh	Ade loamy fine sand, eroded undulating phase (60-70 percent slope)	Jh	Jasper fine sandy loam, mucky subsoil phase (40-50 percent slope)
Ca	Alida loamy fine sand (0-2 percent slope)	Ja	Jasper fine sandy loam, mucky subsoil phase (50-60 percent slope)
Cb	Alida loamy fine sand, undulating phase (2-5 percent slope)	Jk	Jasper fine sandy loam, mucky subsoil phase (60-70 percent slope)
Cc	Alida loamy fine sand, undulating phase (5-8 percent slope)	Jl	Jasper fine sandy loam, mucky subsoil phase (70-80 percent slope)
Cd	Alida loamy fine sand, undulating phase (8-12 percent slope)	Jm	Jasper fine sandy loam, mucky subsoil phase (80-90 percent slope)
Ce	Alida loamy fine sand, undulating phase (12-20 percent slope)	Jn	Jasper fine sandy loam, mucky subsoil phase (90-100 percent slope)
Cf	Alida loamy fine sand, undulating phase (20-30 percent slope)	Ka	Kankakee silt loam (0-2 percent slope)
Cg	Alida loamy fine sand, undulating phase (30-40 percent slope)	Kb	Kibbie loam (0-2 percent slope)
Ch	Alida loamy fine sand, undulating phase (40-50 percent slope)	Kc	Kibbie silt loam (0-2 percent slope)
Ck	Alida loamy fine sand, undulating phase (50-60 percent slope)	La	Lamont fine sandy loam (0-2 percent slope)
Cl	Alida loamy fine sand, undulating phase (60-70 percent slope)	Lb	Lamont fine sandy loam (2-5 percent slope)
Cm	Alida loamy fine sand, undulating phase (70-80 percent slope)	Lc	Lamont fine sandy loam (5-8 percent slope)
Cn	Alida loamy fine sand, undulating phase (80-90 percent slope)	Ld	Lamont fine sandy loam (8-12 percent slope)
Co	Alida loamy fine sand, undulating phase (90-100 percent slope)	Le	Lamont fine sandy loam (12-20 percent slope)
Cr	Alida loamy fine sand, undulating phase (100-110 percent slope)	Lf	Lamont fine sandy loam (20-30 percent slope)
Da	Bridgman sand, undulating phase (0-2 percent slope)	Lg	Lamont fine sandy loam (30-40 percent slope)
Db	Bridgman sand, undulating phase (2-5 percent slope)	Lh	Lamont fine sandy loam (40-50 percent slope)
Dc	Bridgman sand, undulating phase (5-8 percent slope)	Li	Lamont fine sandy loam (50-60 percent slope)
Dd	Bridgman sand, undulating phase (8-12 percent slope)	Lk	Lamont fine sandy loam (60-70 percent slope)
De	Bridgman sand, undulating phase (12-20 percent slope)	Ll	Lamont fine sandy loam (70-80 percent slope)
Df	Bridgman sand, undulating phase (20-30 percent slope)	Lm	Lamont fine sandy loam (80-90 percent slope)
Dg	Bridgman sand, undulating phase (30-40 percent slope)	Ln	Lamont fine sandy loam (90-100 percent slope)
Dh	Bridgman sand, undulating phase (40-50 percent slope)	Lo	Lamont fine sandy loam (100-110 percent slope)
Dk	Bridgman sand, undulating phase (50-60 percent slope)	Ma	Maumee fine sandy loam (0-2 percent slope)
Dl	Bridgman sand, undulating phase (60-70 percent slope)	Mb	Maumee fine sandy loam (2-5 percent slope)
Dm	Bridgman sand, undulating phase (70-80 percent slope)	Mc	Maumee fine sandy loam (5-8 percent slope)
Dn	Bridgman sand, undulating phase (80-90 percent slope)	Md	Maumee fine sandy loam (8-12 percent slope)
Do	Bridgman sand, undulating phase (90-100 percent slope)	Me	Maumee fine sandy loam (12-20 percent slope)
Dr	Bridgman sand, undulating phase (100-110 percent slope)	Mf	Maumee fine sandy loam (20-30 percent slope)
Ea	Edwards muck (0-2 percent slope)	Mg	Maumee fine sandy loam (30-40 percent slope)
Eb	Edwards muck (0-2 percent slope)	Mh	Maumee fine sandy loam (40-50 percent slope)
Ec	Edwards muck, burned phase (0-2 percent slope)	Mk	Maumee fine sandy loam (50-60 percent slope)
Fa	Foresman fine sandy loam (0-2 percent slope)	Ml	Maumee fine sandy loam (60-70 percent slope)
Fb	Foresman loam (0-2 percent slope)	Mm	Maumee fine sandy loam (70-80 percent slope)
Fc	Foresman silt loam (0-2 percent slope)	Mn	Maumee fine sandy loam (80-90 percent slope)
Fe	Fresham fine sandy loam (0-2 percent slope)	Mo	Maumee fine sandy loam (90-100 percent slope)
Fk	Fresham loam (0-2 percent slope)	Mr	Maumee fine sandy loam (100-110 percent slope)
Fl	Fresham silt loam (0-2 percent slope)	Ms	Maumee loamy fine sand (0-2 percent slope)
Ga	Granby fine sandy loam (0-2 percent slope)	Mt	Maumee loamy fine sand (2-5 percent slope)
Gb	Granby mucky subsoil phase (0-2 percent slope)	Mu	Maumee loamy fine sand (5-8 percent slope)
Gc	Granby loamy fine sand (0-2 percent slope)	Mv	Maumee loamy fine sand (8-12 percent slope)
Gd	Griffin fine sandy loam (0-2 percent slope)	Mw	Maumee loamy fine sand (12-20 percent slope)
Ge	Griffin loam (0-2 percent slope)	Mx	Maumee loamy fine sand (20-30 percent slope)
Gf	Griffin loamy fine sand (0-2 percent slope)	My	Maumee loamy fine sand (30-40 percent slope)
Gg	Griffin mucky subsoil phase (0-2 percent slope)	Mz	Maumee loamy fine sand (40-50 percent slope)
Gh	Griffin mucky subsoil phase (2-5 percent slope)	Na	Newton fine sandy loam (0-2 percent slope)
Gk	Griffin mucky subsoil phase (5-8 percent slope)	Nb	Newton fine sandy loam (2-5 percent slope)
Gl	Griffin mucky subsoil phase (8-12 percent slope)	Nc	Newton fine sandy loam (5-8 percent slope)
Gm	Griffin mucky subsoil phase (12-20 percent slope)	Nd	Newton fine sandy loam (8-12 percent slope)
Gn	Griffin mucky subsoil phase (20-30 percent slope)	Ne	Newton fine sandy loam (12-20 percent slope)
Go	Griffin mucky subsoil phase (30-40 percent slope)	Nf	Newton fine sandy loam (20-30 percent slope)
Gp	Griffin mucky subsoil phase (40-50 percent slope)	Ng	Newton fine sandy loam (30-40 percent slope)
Gr	Griffin mucky subsoil phase (50-60 percent slope)	Nh	Newton fine sandy loam (40-50 percent slope)
Gs	Griffin mucky subsoil phase (60-70 percent slope)	Nk	Newton fine sandy loam (50-60 percent slope)
Gt	Griffin mucky subsoil phase (70-80 percent slope)	Nl	Newton fine sandy loam (60-70 percent slope)
Gu	Griffin mucky subsoil phase (80-90 percent slope)	Nm	Newton fine sandy loam (70-80 percent slope)
Gv	Griffin mucky subsoil phase (90-100 percent slope)	Nn	Newton fine sandy loam (80-90 percent slope)
Gw	Griffin mucky subsoil phase (100-110 percent slope)	No	Newton fine sandy loam (90-100 percent slope)
Gx	Griffin mucky subsoil phase (110-120 percent slope)	Np	Newton fine sandy loam (100-110 percent slope)
Gy	Griffin mucky subsoil phase (120-130 percent slope)	Nr	Newton fine sandy loam (110-120 percent slope)
Gz	Griffin mucky subsoil phase (130-140 percent slope)	Ns	Newton fine sandy loam (120-130 percent slope)
Ha	Haggener loamy fine sand, undulating phase (0-2 percent slope)	Nt	Newton fine sandy loam (130-140 percent slope)
Hb	Haggener loamy fine sand, undulating phase (2-5 percent slope)	Nu	Newton fine sandy loam (140-150 percent slope)
Hc	Haggener loamy fine sand, undulating phase (5-8 percent slope)	Nv	Newton fine sandy loam (150-160 percent slope)
Hd	Haggener loamy fine sand, undulating phase (8-12 percent slope)	Nw	Newton fine sandy loam (160-170 percent slope)
He	Haggener loamy fine sand, undulating phase (12-20 percent slope)	Nx	Newton fine sandy loam (170-180 percent slope)
Hf	Haggener loamy fine sand, undulating phase (20-30 percent slope)	Ny	Newton fine sandy loam (180-190 percent slope)
Hg	Haggener loamy fine sand, undulating phase (30-40 percent slope)	Nz	Newton fine sandy loam (190-200 percent slope)
Hh	Haggener loamy fine sand, undulating phase (40-50 percent slope)	Oa	Odell loam (0-2 percent slope)
Hk	Haggener loamy fine sand, undulating phase (50-60 percent slope)	Ob	Odell silt loam (0-2 percent slope)
Hl	Haggener loamy fine sand, undulating phase (60-70 percent slope)	Pa	Palmfield fine sand, undulating phase (0-2 percent slope)
Hm	Haggener loamy fine sand, undulating phase (70-80 percent slope)	Pb	Palmfield fine sand, undulating phase (2-5 percent slope)
Hn	Haggener loamy fine sand, undulating phase (80-90 percent slope)	Pc	Palmfield fine sand, undulating phase (5-8 percent slope)
Ho	Haggener loamy fine sand, undulating phase (90-100 percent slope)	Pd	Palmfield fine sand, undulating phase (8-12 percent slope)
Hr	Haggener loamy fine sand, undulating phase (100-110 percent slope)	Pe	Palmfield fine sand, undulating phase (12-20 percent slope)
Hs	Haggener loamy fine sand, undulating phase (110-120 percent slope)	Pf	Palmfield fine sand, undulating phase (20-30 percent slope)
Ht	Haggener loamy fine sand, undulating phase (120-130 percent slope)	Pg	Palmfield fine sand, undulating phase (30-40 percent slope)
Hu	Haggener loamy fine sand, undulating phase (130-140 percent slope)	Ph	Palmfield fine sand, undulating phase (40-50 percent slope)
Hv	Haggener loamy fine sand, undulating phase (140-150 percent slope)	Pk	Palmfield fine sand, undulating phase (50-60 percent slope)
Hw	Haggener loamy fine sand, undulating phase (150-160 percent slope)	Pl	Palmfield fine sand, undulating phase (60-70 percent slope)
Hx	Haggener loamy fine sand, undulating phase (160-170 percent slope)	Pm	Palmfield fine sand, undulating phase (70-80 percent slope)
Hy	Haggener loamy fine sand, undulating phase (170-180 percent slope)	Pn	Palmfield fine sand, undulating phase (80-90 percent slope)
Hz	Haggener loamy fine sand, undulating phase (180-190 percent slope)	Po	Palmfield fine sand, undulating phase (90-100 percent slope)
Ka	Kankakee silt loam (0-2 percent slope)	Pr	Palmfield fine sand, undulating phase (100-110 percent slope)
Kb	Kankakee silt loam (2-5 percent slope)	Ps	Palmfield fine sand, undulating phase (110-120 percent slope)
Kc	Kankakee silt loam (5-8 percent slope)	Pt	Palmfield fine sand, undulating phase (120-130 percent slope)
Kd	Kankakee silt loam (8-12 percent slope)	Pu	Palmfield fine sand, undulating phase (130-140 percent slope)
Ke	Kankakee silt loam (12-20 percent slope)	Pv	Palmfield fine sand, undulating phase (140-150 percent slope)
Kf	Kankakee silt loam (20-30 percent slope)	Pw	Palmfield fine sand, undulating phase (150-160 percent slope)
Kg	Kankakee silt loam (30-40 percent slope)	Px	Palmfield fine sand, undulating phase (160-170 percent slope)
Kh	Kankakee silt loam (40-50 percent slope)	Py	Palmfield fine sand, undulating phase (170-180 percent slope)
Kk	Kankakee silt loam (50-60 percent slope)	Pz	Palmfield fine sand, undulating phase (180-190 percent slope)
Kl	Kankakee silt loam (60-70 percent slope)	Ra	Rensselaer silt loam (0-2 percent slope)
Km	Kankakee silt loam (70-80 percent slope)	Rb	Rensselaer silt loam (0-2 percent slope)
Kn	Kankakee silt loam (80-90 percent slope)	Rc	Rensselaer silty clay loam (0-2 percent slope)
Ko	Kankakee silt loam (90-100 percent slope)	Rd	Rensselaer silty clay loam (2-5 percent slope)
Kr	Kankakee silt loam (100-110 percent slope)	Re	Rensselaer silty clay loam (5-8 percent slope)
Ks	Kankakee silt loam (110-120 percent slope)	Rf	Rensselaer loam, undulating phase (0-2 percent slope)
Kt	Kankakee silt loam (120-130 percent slope)	Rg	Rensselaer loam, undulating phase (2-5 percent slope)
Ku	Kankakee silt loam (130-140 percent slope)	Rh	Rensselaer loam, undulating phase (5-8 percent slope)
Kv	Kankakee silt loam (140-150 percent slope)	Rk	Rensselaer loam, undulating phase (8-12 percent slope)
Kw	Kankakee silt loam (150-160 percent slope)	Rl	Rensselaer loam, undulating phase (12-20 percent slope)
Kx	Kankakee silt loam (160-170 percent slope)	Rm	Rensselaer loam, undulating phase (20-30 percent slope)
Ky	Kankakee silt loam (170-180 percent slope)	Rn	Rensselaer loam, undulating phase (30-40 percent slope)
Kz	Kankakee silt loam (180-190 percent slope)	Ro	Rensselaer loam, undulating phase (40-50 percent slope)
La	Lamont fine sandy loam (0-2 percent slope)	Rr	Rensselaer loam, undulating phase (50-60 percent slope)
Lb	Lamont fine sandy loam (2-5 percent slope)	Rs	Rensselaer loam, undulating phase (60-70 percent slope)
Lc	Lamont fine sandy loam (5-8 percent slope)	Rt	Rensselaer loam, undulating phase (70-80 percent slope)
Ld	Lamont fine sandy loam (8-12 percent slope)	Ru	Rensselaer loam, undulating phase (80-90 percent slope)
Le	Lamont fine sandy loam (12-20 percent slope)	Rv	Rensselaer loam, undulating phase (90-100 percent slope)
Lf	Lamont fine sandy loam (20-30 percent slope)	Rw	Rensselaer loam, undulating phase (100-110 percent slope)
Lg	Lamont fine sandy loam (30-40 percent slope)	Rx	Rensselaer loam, undulating phase (110-120 percent slope)
Lh	Lamont fine sandy loam (40-50 percent slope)	Ry	Rensselaer loam, undulating phase (120-130 percent slope)
Li	Lamont fine sandy loam (50-60 percent slope)	Rz	Rensselaer loam, undulating phase (130-140 percent slope)
Lk	Lamont fine sandy loam (60-70 percent slope)	Sa	Stockwell loam (0-2 percent slope)
Ll	Lamont fine sandy loam (70-80 percent slope)	Sb	Stockwell loam (2-5 percent slope)
Lm	Lamont fine sandy loam (80-90 percent slope)	Sc	Stroble loam (0-2 percent slope)
Ln	Lamont fine sandy loam (90-100 percent slope)	Sd	Sweger loam (0-2 percent slope)
Lo	Lamont fine sandy loam (100-110 percent slope)	Se	Sweger loam (1-3 percent slope)
Lr	Lamont fine sandy loam (110-120 percent slope)	Sf	Sweger loam (1-3 percent slope)
Ls	Lamont fine sandy loam (120-130 percent slope)	Sg	Sweger loam (2-5 percent slope)
Lt	Lamont fine sandy loam (130-140 percent slope)	Sh	Sweger loam (2-5 percent slope)
Lu	Lamont fine sandy loam (140-150 percent slope)	Sk	Sweger loam (5-12 percent slope)
Lv	Lamont fine sandy loam (150-160 percent slope)	Sl	Sweger loam (5-12 percent slope)
Lw	Lamont fine sandy loam (160-170 percent slope)	Sm	Sweger loam (12-20 percent slope)
Lx	Lamont fine sandy loam (170-180 percent slope)	Sn	Sweger loam (12-20 percent slope)
Ly	Lamont fine sandy loam (180-190 percent slope)	So	Sweger loam (20-30 percent slope)
Lz	Lamont fine sandy loam (190-200 percent slope)	Sp	Sweger loam (20-30 percent slope)
Ma	Alida loamy fine sand (0-2 percent slope)	Sr	Sweger loam (30-40 percent slope)
Mb	Alida loamy fine sand, undulating phase (2-5 percent slope)	Ss	Sweger loam (30-40 percent slope)
Mc	Alida loamy fine sand, undulating phase (5-8 percent slope)	St	Sweger loam (40-50 percent slope)
Md	Alida loamy fine sand, undulating phase (8-12 percent slope)	Su	Sweger loam (40-50 percent slope)
Me	Alida loamy fine sand, undulating phase (12-20 percent slope)	Sv	Sweger loam (50-60 percent slope)
Mf	Alida loamy fine sand, undulating phase (20-30 percent slope)	Sw	Sweger loam (50-60 percent slope)
Mg	Alida loamy fine sand, undulating phase (30-40 percent slope)	Sx	Sweger loam (60-70 percent slope)
Mh	Alida loamy fine sand, undulating phase (40-50 percent slope)	Sy	Sweger loam (60-70 percent slope)
Mk	Alida loamy fine sand, undulating phase (50-60 percent slope)	Sz	Sweger loam (70-80 percent slope)
Ml	Alida loamy fine sand, undulating phase (60-70 percent slope)	Ta	Tippecanoe loam (0-2 percent slope)
Mm	Alida loamy fine sand, undulating phase (70-80 percent slope)	Tb	Tuscola loam, undulating phase (2-5 percent slope)
Mn	Alida loamy fine sand, undulating phase (80-90 percent slope)	Tc	Tuscola silt loam, eroded undulating phase (2-5 percent slope)
Mo	Alida loamy fine sand, undulating phase (90-100 percent slope)	Td	Tuscola silt loam, moderately steep phase (12-20 percent slope)
Mr	Alida loamy fine sand, undulating phase (100-110 percent slope)	Wa	Wabash silt loam (0-2 percent slope)
Ms	Alida loamy fine sand, undulating phase (110-120 percent slope)	Wb	Wabash silty clay loam (0-2 percent slope)
Mt	Alida loamy fine sand, undulating phase (120-130 percent slope)	We	Weiss fine sand (0-2 percent slope)
Mu	Alida loamy fine sand, undulating phase (130-140 percent slope)	Wf	Weiss fine sand, wind-eroded phase (0-2 percent slope)
Mv	Alida loamy fine sand, undulating phase (140-150 percent slope)	Ww	Wolcott fine sand (0-2 percent slope)
Mw	Alida loamy fine sand, undulating phase (150-160 percent slope)	Wy	Wolcott fine sand, wind-eroded phase (0-2 percent slope)
Mx	Alida loamy fine sand, undulating phase (160-170 percent slope)		
My	Alida loamy fine sand, undulating phase (170-180 percent slope)		
Mz	Alida loamy fine sand, undulating phase (180-190 percent slope)		

SOILS WITH MODERATE TO FAIRLY STEEP SLOPES

Haggener loamy fine sand, wind-eroded rolling phase
Jasper fine sandy loam, eroded sloping phase
Jasper silt loam, eroded sloping phase
Jasper loam, eroded sloping phase
Marne silt loam, eroded sloping phase
Marne silt loam, moderately steep phase
Parr loam, eroded sloping phase
Parr silt loam, eroded sloping phase
Tuscola silt loam, moderately steep phase

SOILS WITH GENTLE SLOPES

EXCESSIVELY DRAINED DARK-COLORED SANDY SOILS

Ade fine sandy loam, undulating phase
Ade loamy fine sand, undulating phase
Haggener loamy fine sand, undulating phase
Haggener loamy fine sand, undulating phase

EXCESSIVELY DRAINED LIGHT-COLORED SANDS

Bridgman sand, undulating phase
Bridgman sand, undulating phase

IMPERFECTLY AND POORLY DRAINED DARK SOILS OVER LOAMY SUBSOILS

Clyde silty clay loam, undulating phase
Clyde silty clay loam, eroded undulating phase
Data silty clay loam
Dunbarton loam
Dunbarton silt loam
Linwood silty clay loam
Linwood silt loam
Milford silty clay loam
Milford silt loam
Rensselaer silty clay loam
Rensselaer silt loam
Stoy loam
Stoy silt loam

IMPERFECTLY AND POORLY DRAINED DARK-COLORED MEDIUM TO FINE-TEXTURED SOILS

Cohoctah loam
Cohoctah silty clay loam
Lawrence loam
Lawrence silt loam
Lawrence fine sandy loam
Shoals loam
Shoals silt loam
Sloan loam
Sloan silt loam

MODERATELY WELL-DRAINED SANDY SOILS OVER LOOSE SANDS

Alida loamy fine sand
Bernen loamy fine sand, severely eroded phase
Bernen loamy fine sand, wind-eroded phase
Maxwood fine sandy loam
Maxwood loamy fine sand

POORLY DRAINED DARK SANDY SOILS OVER LOOSE SANDS

Carmel fine sand
Edwards muck, burned phase
Houghton muck, burned phase over sand
Houghton muck, burned phase over sand
Wallkill fine sand
Wallkill loamy fine sand
Wallkill silt loam

VERY POORLY DRAINED DARK SANDY SOILS SLIGHTLY ACID TO NEUTRAL

Gravby fine sandy loam
Gravby fine sandy loam, mucky subsoil phase
Gravby loamy fine sand
Maumee fine sandy loam
Maumee fine sandy loam, mucky subsoil phase
Maumee loamy fine sand
Maumee loamy fine sand

VERY POORLY DRAINED DARK SANDY SOILS STRONGLY ACID

Dillon fine sandy loam
Dillon loamy fine sand
Newton fine sandy loam
Newton loamy fine sand

ALLUVIAL SOILS

Carlisle fine sandy loam
Carlisle loamy fine sand
Kokomo silt loam
Wallkill silt loam
Wallkill silty clay loam

ORGANIC SOILS

Cathedral loamy muck
Cathedral muck
Houghton muck over sand
Houghton muck, shallow phase over sand

IMPERFECTLY AND POORLY DRAINED DARK-COLORED MEDIUM TO FINE-TEXTURED SOILS

Cohoctah loam
Cohoctah silty clay loam
Lawrence loam
Lawrence silt loam
Lawrence fine sandy loam
Lincoln loam
Lincoln silt loam
Lincoln fine sandy loam
Shoals loam
Shoals silt loam
Shoals silty clay loam
Sloan loam
Sloan silt loam

MODERATELY WELL TO IMPERFECTLY DRAINED SANDY SOILS OVER LOOSE SANDS

Alida loamy fine sand
Bernen loamy fine sand, severely eroded phase
Bernen loamy fine sand, wind-eroded phase
Maxwood fine sandy loam
Maxwood loamy fine sand

COLOR GROUPING

Ade loamy fine sand, undulating phase	Lamont fine sandy loam, undulating phase
Ade loamy fine sand, undulating phase	Lamont fine sandy loam, undulating phase
Haggener loamy fine sand, undulating phase	Lamont fine sandy loam, undulating phase
Haggener loamy fine sand, undulating phase	Tuscola silt loam, undulating phase

SOILS WITH GENTLE SLOPES

EXCESSIVELY DRAINED DARK-COLORED SANDY SOILS

Ade fine sandy loam, undulating phase
Ade loamy fine sand, undulating phase
Haggener loamy fine sand, undulating phase
Haggener loamy fine sand, undulating phase

IMPERFECTLY AND POORLY DRAINED DARK-COLORED MEDIUM TO FINE-TEXTURED SOILS

Cohoctah loam
Cohoctah silty clay loam
Lawrence loam
Lawrence silt loam
Lincoln loam
Lincoln silt loam
Lincoln fine sandy loam
Shoals loam
Shoals silt loam
Sloan loam
Sloan silt loam

MODERATELY WELL TO IMPERFECTLY DRAINED SANDY SOILS OVER LOOSE SANDS

Alida loamy fine sand
Bernen loamy fine sand, severely eroded phase
Bernen loamy fine sand, wind-eroded phase
Maxwood fine sandy loam
Maxwood loamy fine sand

CONVENTIONAL SIGNS

CULTURE (Printed in black)

- City or Village, Roads, Railroads, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Bridges, Ferry
- Steam and Electric R.R., Triangle, Tunnel
- Ford, Dam, Small Wharf
- Boundary lines
- School, Church, Cemetery, Crossroads
- Boundary lines
- Mercuris Boundary Mountain
- Township and Section lines
- Recovered corners
- Airway Beacon, Flood fire station
- Oil or Gas pipe line, Transmission line
- Oil or Gas wells
- Canal or sand pits, Rock outcrop, Made land
- Soil boundaries, Sloughs, Gravelly and Cherry areas

RELIEF (Printed in brown)

- Contours
- Depression contours
- Sand, Wash, and Sand dunes
- Bluff, Escarpment, Mountain peaks
- Prominent hills
- Streams, Springs, Wells, Flowing wells
- Lakes, Ponds, Intermittent lakes
- Intermittent drainage, Canal
- Crossable with farm machinery
- Not crossable with farm machinery
- Dams

DRAINAGE (Printed in blue)

- Swamp
- Submerged marsh
- Salt marshes

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

TABLE 11.—*Key to the soil series of Newton County, Ind.* [1]

Topographic position and derivation	Great soil group														
	Prairie soils [2]				Humic Gley soils [3]		Gray-Brown Podzolic soils				Low Humic Gley soils [4]		Alluvial soils		Bog soils
Major profile (Indiana system)	V	IV	III	II	VIII	IX	V	IV	III	II	II	IX	IV	II	X
Drainage under natural conditions	Excessive	Well to somewhat excessive.	Moderately well	Imperfect	Very poor	Very poor	Excessive	Well	Moderately well	Imperfect	Imperfect	Very poor	Well	Imperfect	Very poor.
Relief	Level to rolling	Nearly level to moderately steep.	Nearly level to gently undulating.	Nearly level	Nearly level to slightly depressed.	Nearly level to depressional.	Undulating to rolling.	Nearly level to moderately steep.	Nearly level to undulating.	Nearly level	Nearly level	Nearly level to depressed.	Nearly level	Nearly level	Depressions or broad depressed flats.
Color: [5]															
Surface soil	Dark brown	Dark brown to dark grayish brown.	Dark brownish gray to dark grayish brown.	Dark brownish gray to very dark gray.	Very dark gray to very dark brownish gray.	Very dark gray to nearly black.	Grayish brown to yellowish brown.	Grayish brown to yellowish brown.	Grayish brown to yellowish brown.	Brownish gray	Brownish gray	Dark gray to gray	Dark grayish brown	Brownish gray to yellowish gray.	Very dark brownish gray to black.
Subsurface soil	do	do	do	Dark gray	Dark gray	Very dark gray	Brownish yellow	Yellowish brown to brownish yellow.	Yellowish brown to pale brown.	Mottled gray, yellow, and brown.	Mottled gray, yellow, and brown.	Gray	Dark grayish brown to dark brown.	Yellowish gray, mottled with yellow and brown.	Very dark gray
Subsoil	Yellowish brown	Yellowish brown	Dark brownish gray to pale yellow.	Mottled gray, yellow, and brown.	Mottled gray, yellow, and brown.	Gray	do	do	Mottled gray and yellow.	do	do	do	Brown	Mottled yellow, gray, and brown.	Brown, yellow, gray.
Lower subsoil	Yellowish brown to brownish yellow.	Yellowish brown to brownish yellow.	Mottled yellow, gray, and brown.	do	do	Mottled gray, yellow, and brown.	do	do	do	do	do	do	do	do	Do.
SOILS OF UPLANDS															
Parent or underlying material:															
Highly calcareous light-to-medium-textured glacial till.		Parr	Corwin	Odell	Chalmers	Clyde		Miami		Crosby					
Highly calcareous light-textured (gravel) glacial drift.	Stockwell														
Highly calcareous heavy-textured glacial till (heavy clay loam to silty clay).			Swygert												
Highly calcareous very heavy-textured glacial till (clay).				Clarence											
Noncalcareous loose sandy drift	Ade						Coloma								
Noncalcareous sandy drift over highly calcareous till.		Ayr	Deardurff												
SOILS OF GLACIOFLUVIAL OUTWASH PLAINS AND LAKE PLAINS															
Parent or underlying material:															
Calcareous stratified sands and silt with some clay.		Jasper	Foresman	Darroch	Rensselaer	Della		Tuscola		Kibbie					
Calcareous stratified gravel			Tippecanoe												
Highly calcareous lake-laid clay				Strole	Julian										
Noncalcareous sand	Hagener														
Do.			Alida [6]		Newton	Dillon	Plainfield		Berrien		Morocco				
Calcareous sand					Granby	Maumee					Weiss	Conrad			
Noncalcareous loose sand on dunes							Bridgman								
Thin muck or dark neutral sandy material over calcareous sands.											Wooten				
SOILS OF FLOOD PLAINS															
Parent or underlying material:															
Stratified silt and clay; neutral to calcareous.					Wabash										
Stratified silts													Kaskaskia		
Stratified layers of sand and silt; neutral to calcareous.														Griffin	
ORGANIC SOILS															
Parent or underlying material:															
Muck over highly calcareous gray marl															Edwards.
Peaty material from reeds and sedges over sandy material.															Houghton.

[1] Soils that would key into some of the blank spaces have been mapped elsewhere in the State.
[2] The name "Brunigra" has been proposed for the great soil group called Prairie soils.
[3] The Humic Gley soil group includes soils formerly recognized as Weisenboden soils.
[4] The Low Humic Gley soil group includes soils formerly recognized as Gray Hydromorphic soils.
[5] Colors are necessarily general and may not conform in detail to the colors given in individual soil descriptions; surface colors are for cultivated areas.
[6] The Alida is not a true Prairie soil but constitutes a transition from Prairie to Gray-Brown Podzolic soils.

968833—55 (Face p. 132)